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(54) **RECORDING APPARATUS AND RECORDING METHOD IN RECORDING APPARATUS**

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(52) **U.S. Cl.**
USPC **347/14**; 347/16

(58) **Field of Classification Search**
USPC 347/14, 16, 19, 21, 101, 104, 105
See application file for complete search history.

(56) **References Cited**

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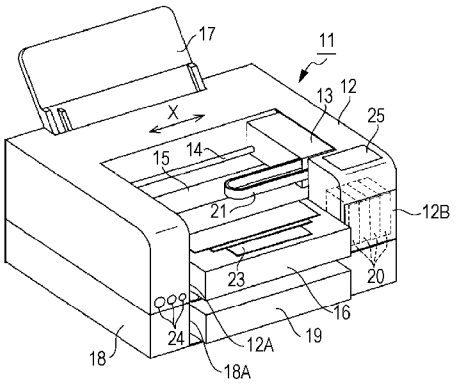
(57) **ABSTRACT**

In a feeding course, a first design side end position Xsn of a paper is calculated. A first side end position of the paper is detected by a paper width detector, and the detected position is set to a first side end position Xd**1**. When the paper is fed from an additional cassette and a paper end detection flag F**1**=1, an ejection starting position adjustment amount ΔX=Xd**1**−Xsn is set. However, when the deviation amount is not |Xd**1**−Xsn|≤L, the ejection starting position adjustment amount ΔX is limited to a limit value L.

7 Claims, 7 Drawing Sheets



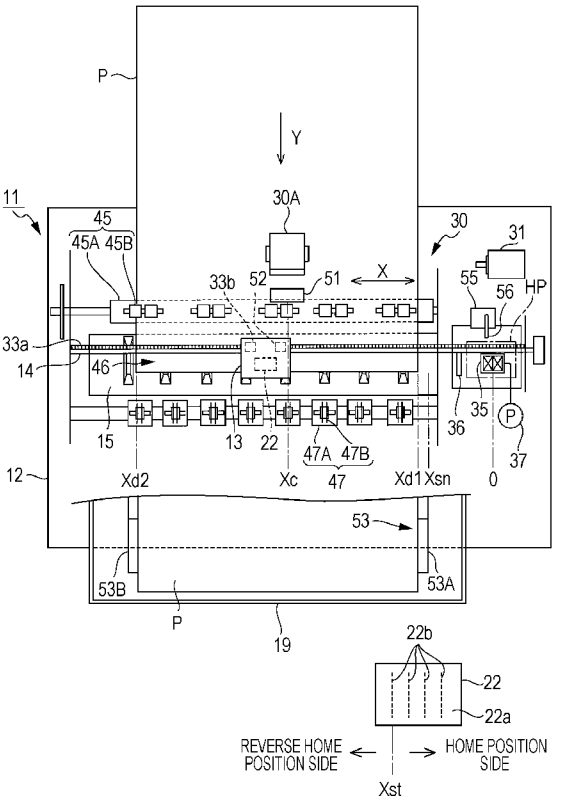


FIG. 1

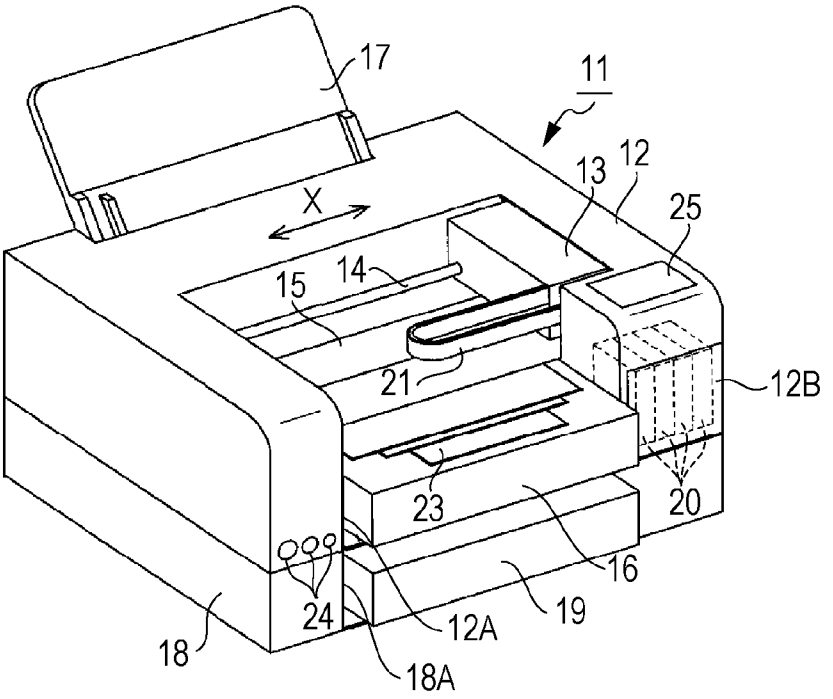

17
11
13
12
25
X
15
14
21
12B
23
20
16
24
12A
19
18
18A

FIG. 2

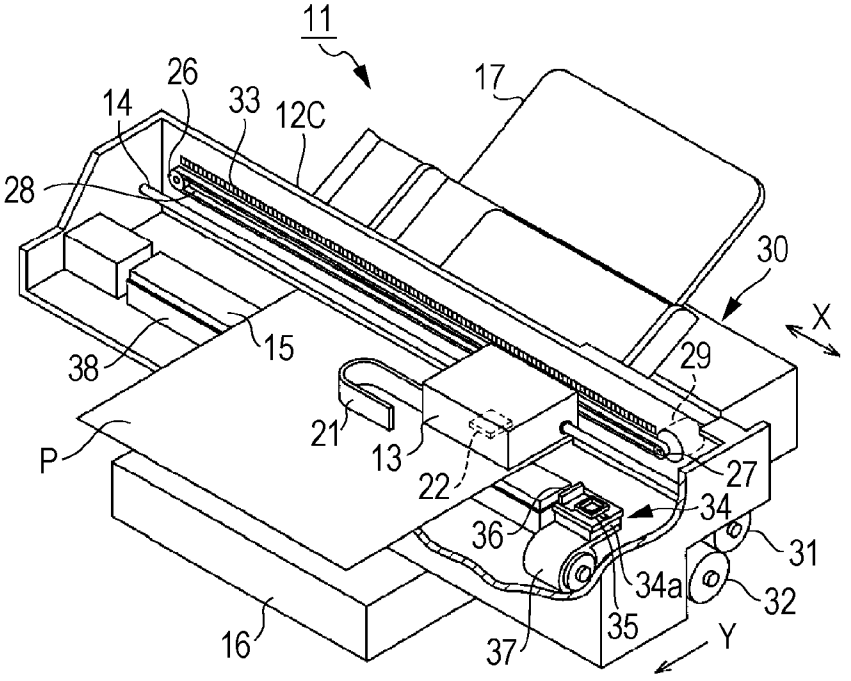

11
26
14
33
12C
17
28
30
X
38
15
29
21
13
P
22
27
34
36
31
34a
32
35
16
37
Y

FIG. 3

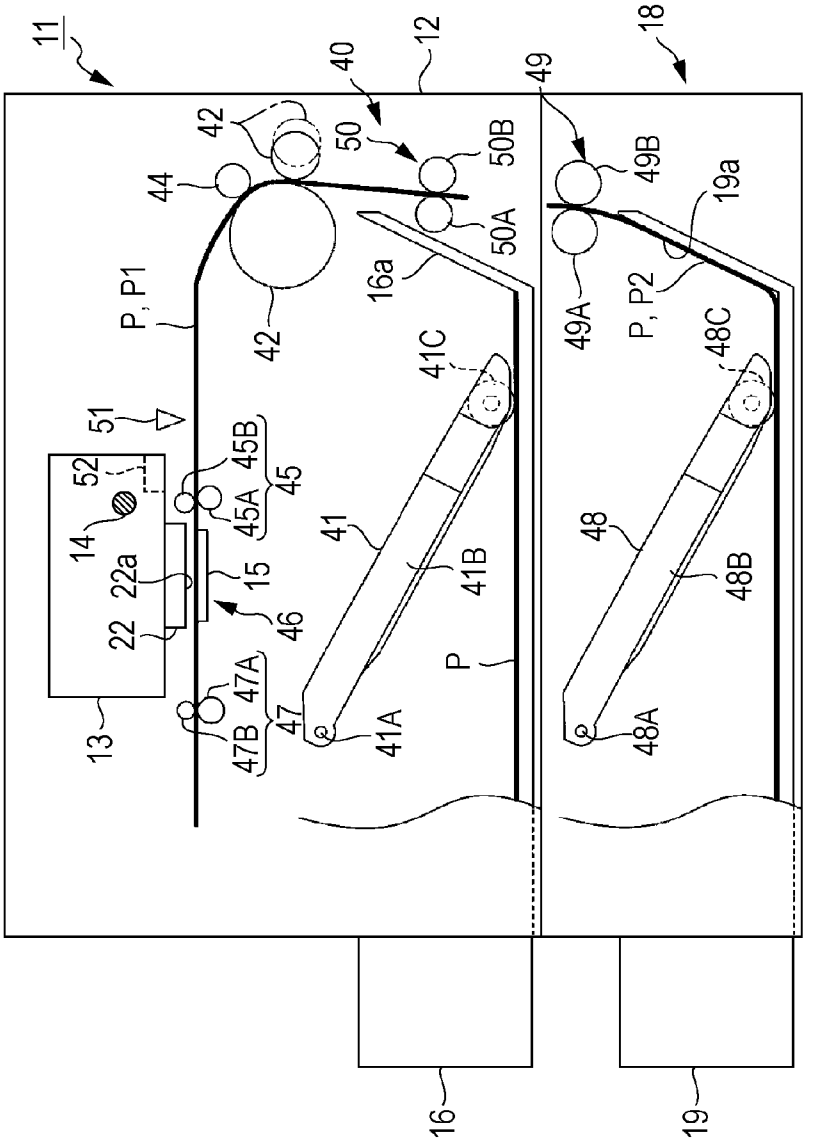

11
12
18
40
49
42
50
50B
44
49B
19a
50A
16a
49A
P, P1
P, P2
42
41C
48C
51
52
45B
45
41
48
14
22a
15
41B
48B
22
46
P
47A
47
41A
48A
13
47B
16
19

FIG. 4

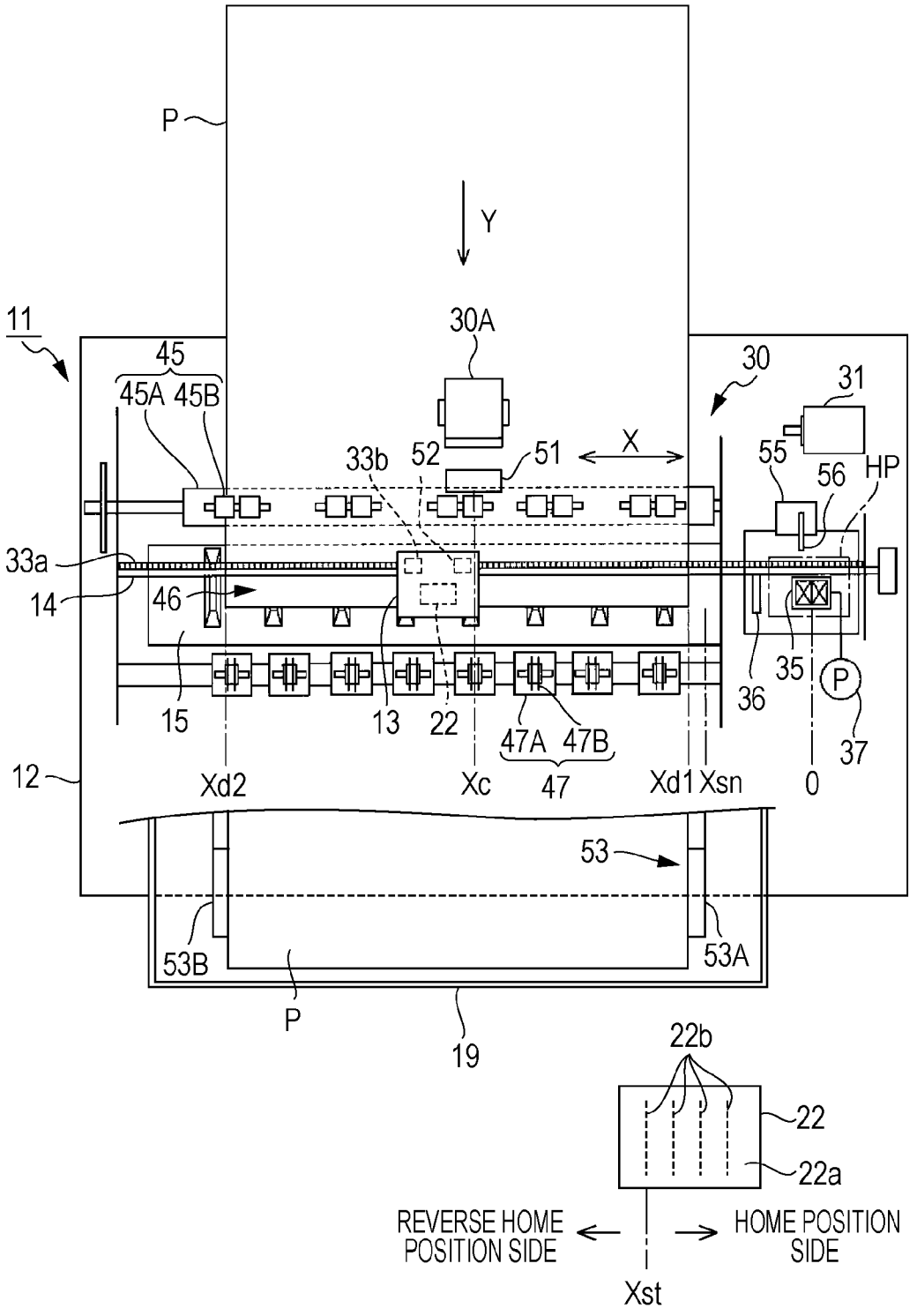

P
Y
11
30A
45
45A
45B
30
31
33b
52
51
X
55
56
HP
33a
14
46
36
35
P
15
13
22
47A
47B
37
12
Xd2
Xc
47
Xd1
Xsn
0
53
53B
53A
P
19
22b
22
22a
REVERSE HOME POSITION SIDE
HOME POSITION SIDE
Xst

FIG. 5

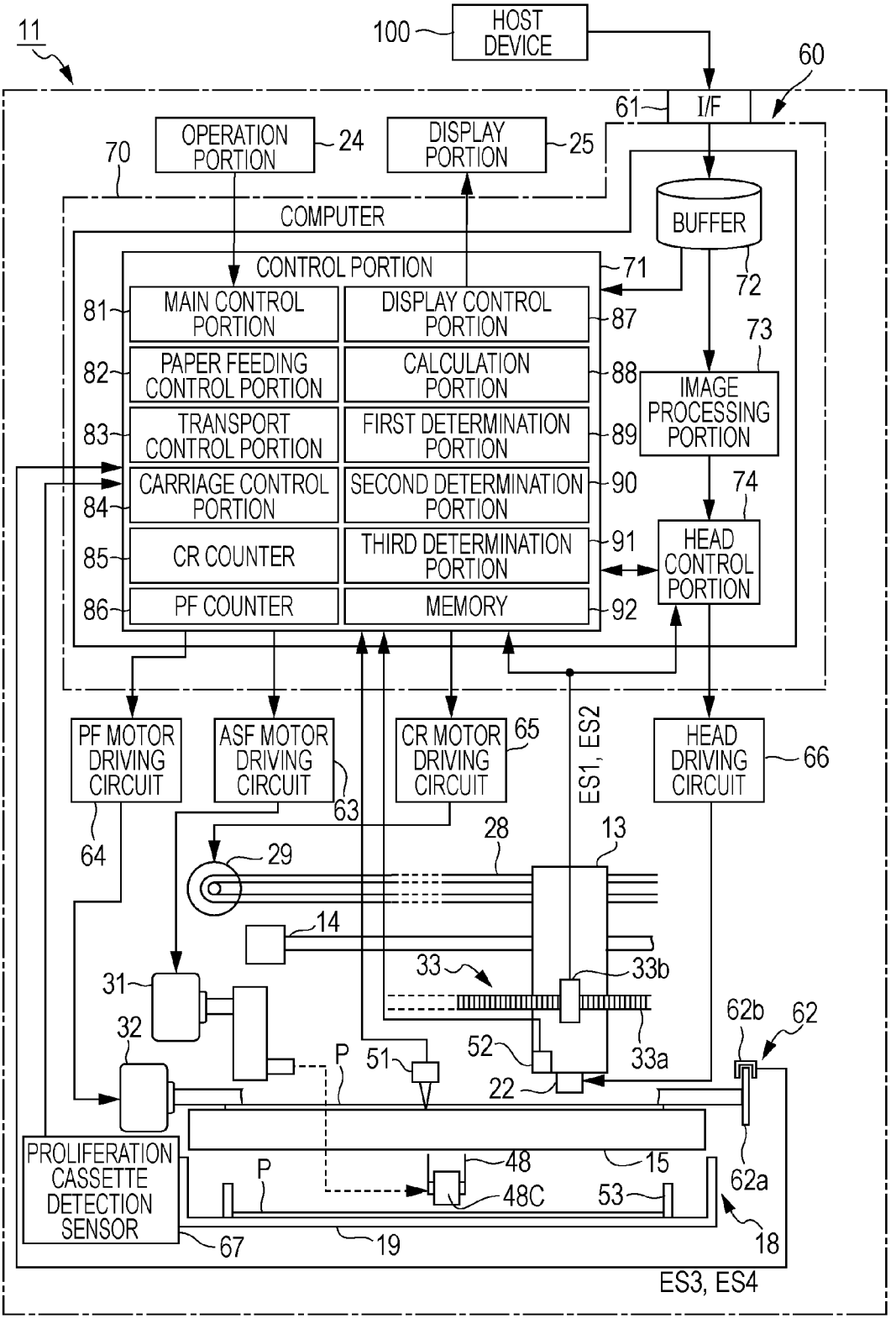

11
100
HOST DEVICE
60
61
I/F
OPERATION PORTION
24
DISPLAY PORTION
25
70
COMPUTER
BUFFER
72
CONTROL PORTION
71
81
MAIN CONTROL PORTION
DISPLAY CONTROL PORTION
87
73
82
PAPER FEEDING CONTROL PORTION
CALCULATION PORTION
88
IMAGE PROCESSING PORTION
83
TRANSPORT CONTROL PORTION
FIRST DETERMINATION PORTION
89
74
84
CARRIAGE CONTROL PORTION
SECOND DETERMINATION PORTION
90
85
CR COUNTER
THIRD DETERMINATION PORTION
91
HEAD CONTROL PORTION
86
PF COUNTER
MEMORY
92
PF MOTOR DRIVING CIRCUIT
ASF MOTOR DRIVING CIRCUIT
63
CR MOTOR DRIVING CIRCUIT
65
ES1, ES2
HEAD DRIVING CIRCUIT
66
64
28
13
29
14
33
33b
31
32
P
51
52
33a
62b
62
22
PROLIFERATION CASSETTE DETECTION SENSOR
48
15
62a
48C
53
67
19
18
ES3, ES4

FIG. 6

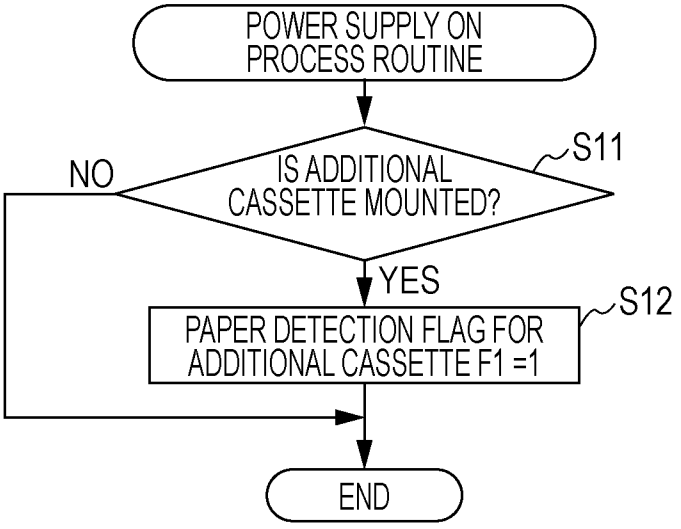

POWER SUPPLY ON PROCESS ROUTINE
IS ADDITIONAL CASSETTE MOUNTED?
S11
NO
YES
PAPER DETECTION FLAG FOR ADDITIONAL CASSETTE F1 =1
S12
END

FIG. 7

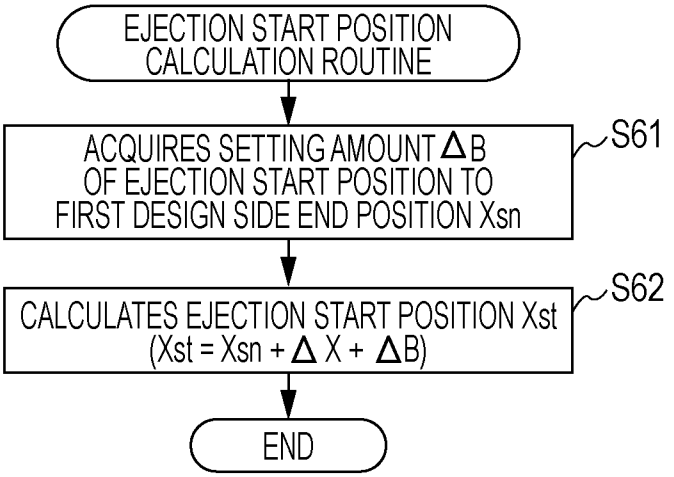

EJECTION START POSITION CALCULATION ROUTINE
ACQUIRES SETTING AMOUNT ΔB OF EJECTION START POSITION TO FIRST DESIGN SIDE END POSITION Xsn
S61
CALCULATES EJECTION START POSITION Xst (Xst = Xsn + Δ X + ΔB)
S62
END

FIG. 8

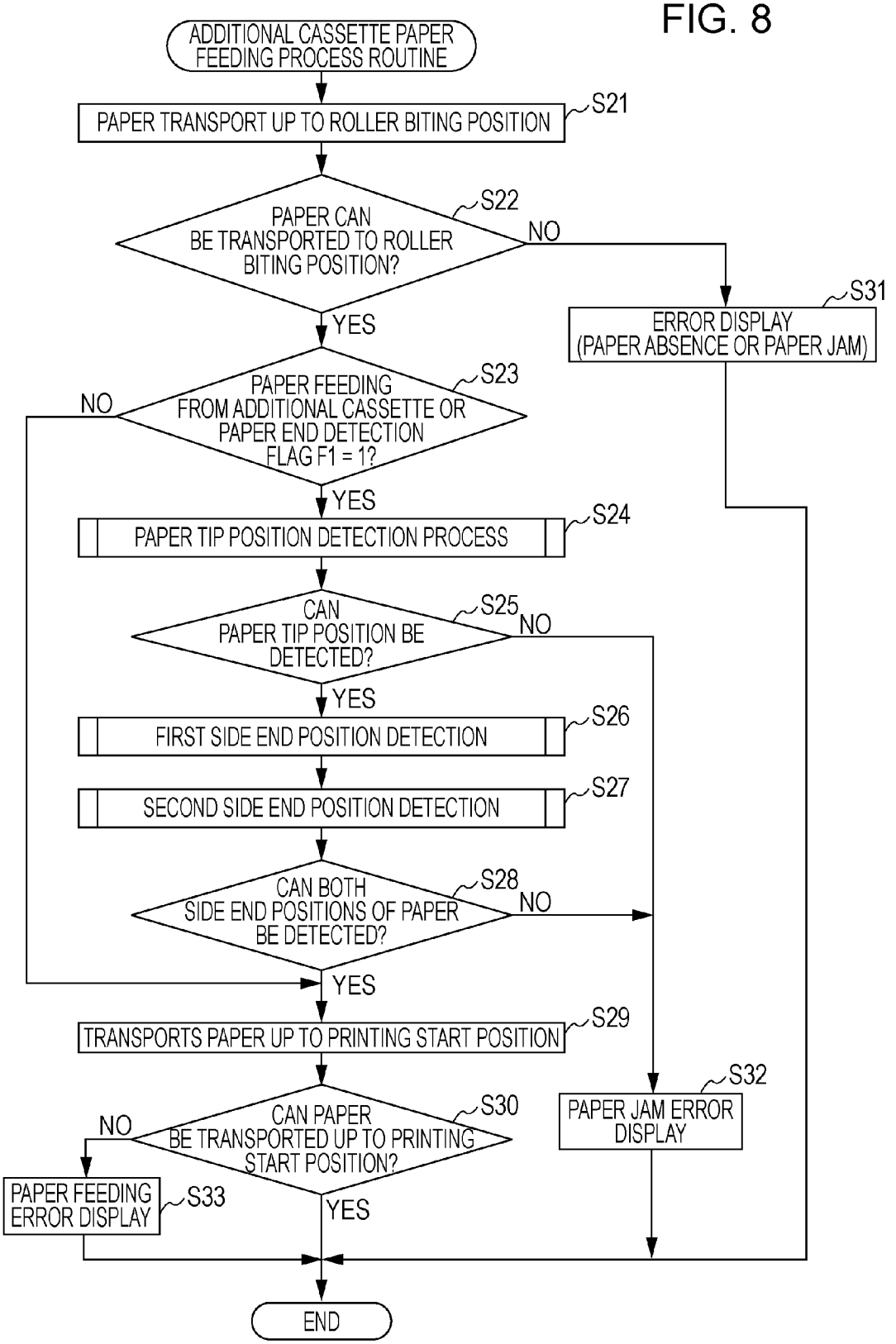
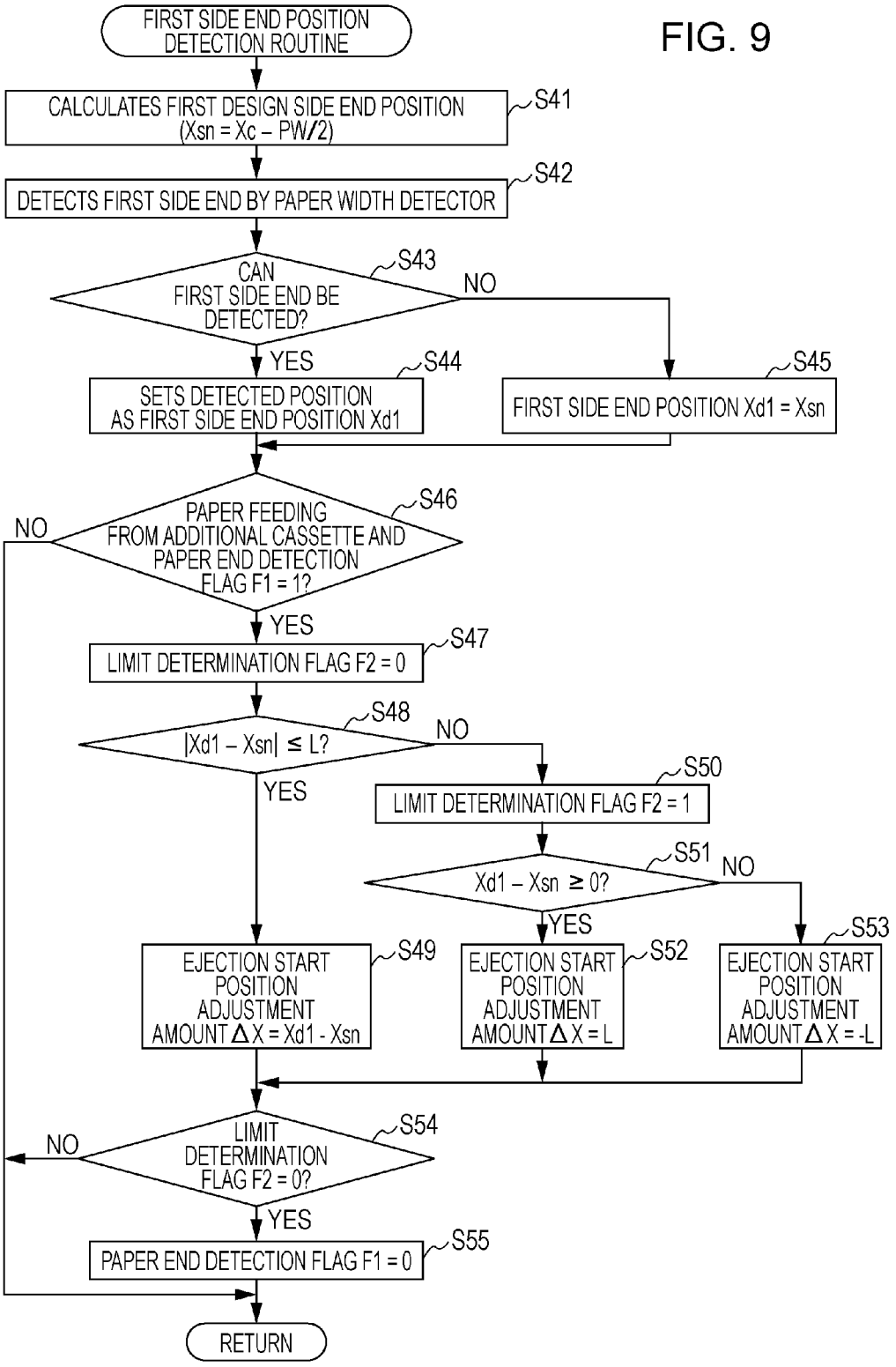

ADDITIONAL CASSETTE PAPER FEEDING PROCESS ROUTINE
PAPER TRANSPORT UP TO ROLLER BITING POSITION
S21
PAPER CAN BE TRANSPORTED TO ROLLER BITING POSITION?
S22
NO
YES
ERROR DISPLAY (PAPER ABSENCE OR PAPER JAM)
S31
PAPER FEEDING FROM ADDITIONAL CASSETTE OR PAPER END DETECTION FLAG F1 = 1?
S23
NO
YES
PAPER TIP POSITION DETECTION PROCESS
S24
CAN PAPER TIP POSITION BE DETECTED?
S25
NO
YES
FIRST SIDE END POSITION DETECTION
S26
SECOND SIDE END POSITION DETECTION
S27
CAN BOTH SIDE END POSITIONS OF PAPER BE DETECTED?
S28
NO
YES
TRANSPORTS PAPER UP TO PRINTING START POSITION
S29
CAN PAPER BE TRANSPORTED UP TO PRINTING START POSITION?
S30
NO
YES
PAPER JAM ERROR DISPLAY
S32
PAPER FEEDING ERROR DISPLAY
S33
END

FIG. 9


FIRST SIDE END POSITION DETECTION ROUTINE
CALCULATES FIRST DESIGN SIDE END POSITION (Xsn = Xc – PW/2)
S41
DETECTS FIRST SIDE END BY PAPER WIDTH DETECTOR
S42
CAN FIRST SIDE END BE DETECTED?
S43
NO
YES
SETS DETECTED POSITION AS FIRST SIDE END POSITION Xd1
S44
FIRST SIDE END POSITION Xd1 = Xsn
S45
PAPER FEEDING FROM ADDITIONAL CASSETTE AND PAPER END DETECTION FLAG F1 = 1?
S46
NO
YES
LIMIT DETERMINATION FLAG F2 = 0
S47
|Xd1 – Xsn| ≤ L?
S48
NO
YES
LIMIT DETERMINATION FLAG F2 = 1
S50
Xd1 – Xsn ≥ 0?
S51
NO
YES
EJECTION START POSITION ADJUSTMENT AMOUNT ΔX = Xd1 - Xsn
S49
EJECTION START POSITION ADJUSTMENT AMOUNT ΔX = L
S52
EJECTION START POSITION ADJUSTMENT AMOUNT ΔX = -L
S53
LIMIT DETERMINATION FLAG F2 = 0?
S54
NO
YES
PAPER END DETECTION FLAG F1 = 0
S55
RETURN

RECORDING APPARATUS AND RECORDING METHOD IN RECORDING APPARATUS

This application claims priority to Japanese Patent Application No. 2010-260940, filed Nov. 24, 2010, the entirety of which is incorporated by reference herein.

BACKGROUND

1. Technical Field

The present invention relates to a recording apparatus on which a feeding device is detachably mounted for feeding a recording medium on a recording apparatus main body, particularly, a recording apparatus that includes a function of adjusting a limit position of a recording range of a recording unit in a width direction intersecting with a transport direction of a recording medium, and a recording method in the recording apparatus.

2. Related Art

For example, in an ink jet type serial printer, a carriage capable of being moved in a main scanning direction is included, and a paper is printed by ejecting ink droplets from nozzles of a recording head provided below the carriage while causing the carriage to reciprocate in the main scanning direction.

In the related art, an image forming device is known which includes a plurality of paper feeding portions such as a paper feeding tray accommodating a plurality of sheets of paper, or an input tray for feeding a paper other than one having the size to be accommodated in the paper feeding tray or a special paper.

For example, in JP-A-2006-36429, the size of the paper transported from a plurality of paper feeding portions such as the paper feeding tray or the input tray is detected by a size detection unit (for example, an ultraviolet sensor) provided in the carriage. The size detection unit detects the size of the recording paper on a transport path through which the recording papers transported from the respective paper feeding portions commonly pass. Furthermore, the detection result of the paper size is memorized in a memory portion in association with each paper feeding portion. For this reason, since there is no need to detect the paper size whenever the papers are transported even if the size detection units are not provided by a number of the paper feeding portion, the image forming speed does not drop. Furthermore, there is also a configuration in which, in at least one of the plurality of paper feeding portions, in order to add a paper feeding cassette to a printer, the paper feeding device is mounted on the printer main body in a detachable manner.

In this kind of serial printer, as a standard position that is based in determining a recording starting position (an ejection starting position) in the main scanning direction of the carriage upon performing the printing, a design (theoretical) side end position of the paper or a position of a predetermined distance of the design side end position is the standard position. Moreover, a position separated from the standard position by a predetermined amount, which is defined from a print setting condition concerning a layout or the like such as a margin amount of a width direction (the main scanning direction) of the paper or the presence or absence of borderless printing, is obtained as the recording starting position. In addition, the recording starting position refers to the outermost position of the main scanning direction in which the starting of the ejection of the ink droplet from the recording head is permitted, but not necessarily refers to an actual ink ejection starting position. This is because the actual ink ejection starting position depends on the print data, in the case of the pixel other than a white pixel, ink is ejected, but, ink is not ejected in the white pixel. For example, when the print data is a solid printing, the recording starting position coincides with the actual recording starting position.

However, when the additional paper feeding device is mounted, an actual side end position of the paper deviates by the irregularity of the mounting positions. When the actual side end position of the paper deviates from the design (theoretical) side end position of the paper, even if the recording starting position is calculated based on the standard position such as the design side end position, a mounting deviation amount is not considered in the calculation value. For this reason, a printing target such as a document or an image is printed in a recording range that deviates in the width direction of the paper against the print setting such as the margin amount. For this reason, in the case of printing the paper that is fed from the additional paper feeding device, there was a problem in that the margin amount of the print setting is not ensured, or a minute margin is generated at an edge during borderless printing.

SUMMARY

An advantage of some aspects of the invention is to provide a recording apparatus that is able to suppress the deviation of a recording range onto a recording medium due to a mounting deviation of a detachable feeding device, and a recording method in the recording apparatus.

According to the aspect of the invention, there is provided a recording apparatus on which a feeding device is detachably mounted for feeding a recording medium, the recording apparatus includes a transport unit that transports the recording medium; a recording unit that records the recording medium; an acquisition unit that acquires a theoretical side end position in a width direction intersecting with a transport direction of the recording medium; a detection unit that detects a side end position of the recording medium fed from the feeding device in a feeding course; a calculation unit that calculates a deviation amount between the side end position detected by the detection unit and the theoretical side end position as an adjustment amount; and an adjustment unit that adjusts a limit position of a recording range in the width direction in which the recording of the recording unit is permitted by the use of the adjustment amount.

According to the aspect of the invention, the detection unit detects the side end position of the recording medium fed from the feeding device in a feeding course. Moreover, the calculation unit calculates the deviation amount between the side end position detected by the detection unit and the theoretical side end position as the adjustment amount. The adjustment unit adjusts the limit position of the recording range in the width direction in which the recording of the recording unit is permitted by the use of the adjustment amount. Thus, it is possible to suppress the deviation of the recording range to the recording medium in the width direction due to the mounting deviation of the detachable feeding device.

In the recording apparatus according to the aspect of the invention, it is preferable that the detection unit detect the side end position of the recording medium which is fed from the feeding device in the first page of the initial recording after the feeding device is mounted after the power source is input.

According to the aspect of the invention, the detection unit detects the side end position of the recording medium which is fed from the feeding device in the first page of the initial recording after the feeding device is mounted after the power source is input. Thus, when the recording is performed by the

feeding from the detachable feeding device, it is possible to suppress the deviation of the recording range in the width direction from the first page of the initial recording.

In the recording apparatus according to the aspect of the invention, it is preferable that the recording unit be a carriage which has a recording head and can be moved in the width direction, the detection unit include a medium width detection unit which is provided in the carriage and can detect both side end positions of the recording medium in the width direction by the movement of the carriage, the detection unit move the carriage before the recording starting in the feeding course from the feeding device to detect both side end positions including the side end position of the recording medium by the medium width detection unit, and the adjustment unit adjust the recording starting position of the recording head, which is moved together with the carriage by the use of the adjustment amount to perform the recording.

According to the aspect of the invention, both side end positions of the recording medium in the width direction are detected by the medium width detection unit provided in the carriage. The adjustment amount is calculated by the use of at least one side end position of the both side end positions detected at this time. Moreover, the recording starting position of the recording head is adjusted by the adjustment unit by the use of the adjustment amount. Thus, in the serial type recording apparatus, the recording starting position of the recording head is adjusted, whereby it is possible to suppress the deviation of the recording range of the recording medium in the width direction.

In the recording apparatus according to the aspect of the invention, it is preferable that an error detection unit be further included which detects the feeding error of the recording medium, when the feeding error of the recording medium is detected before the adjustment by the adjustment unit, the side end position is detected in the next feeding course from the feeding device after the feeding error is released, and the adjustment unit adjusts the limit position of the recording range by the use of the acquired adjustment amount.

According to the aspect of the invention, when the feeding error of the recording medium is detected before the adjustment by the adjustment unit, by the use of the adjustment amount based on the side end position detected in the next feeding course from the feeding device after the feeding error is released, the adjustment unit adjusts the limit position of the recording range. Thus, even when the feeding error is generated, and it is difficult to acquire one of the side end position, the adjustment amount, and the limit position of the recording range, and as a result, it is difficult to adjust the limit position of the recording range, the adjustment amount is acquired again in the next feeding course from the feeding device after the feeding error is released. For this reason, even when the feeding error is unintentionally generated when the adjustment amount is initially acquired, it is possible to suppress the deviation of the recording range in the width direction during next recording.

In the recording apparatus according to the aspect of the invention, it is preferable that a determination unit be further included which determines whether or not a deviation amount exceeds the limit value, and the adjustment unit limits the adjustment amount to the limit value when it is determined that the deviation amount exceeds the limit value.

According to the aspect of the invention, when it is determined that the deviation amount exceeds the limit value, the adjustment amount is limited to the limit value by the determination unit. The adjustment unit adjusts the limit position of the recording range by the use of the limited adjustment amount. For example, even when an excessive deviation amount is generated due to the fact that the recording medium set position in the feeding device deviates, the limit position of the recording range is adjusted by the use of the adjustment amount limited to the limit value. Thus, the limit position of the recording range is adjusted according to the deviation of the set positions, and then it is possible to avoid the disadvantage due to that fact that the excessive adjustment amount is continuously used.

In the recording apparatus according to the aspect of the invention, it is preferable that, after the limit position of the recording range is adjusted by the adjustment unit, until the power source is cut off, the recording by the recording unit is performed by the use of the limit position of the adjusted recording range.

According to the aspect of the invention, after the limit position of the recording range is adjusted by the adjustment unit, until the power source is cut off, the recording by the recording unit be performed by the use of the limit position of the adjusted recording range. Thus, whenever the recording medium fed from the feeding device is recorded, the processes including the detection of the side end position, the calculation of the adjustment amount, and the adjustment of the limit position of the recording range are not performed. As a consequence, it is possible to improve throughput of the recording to the recording medium that is fed from the feeding device.

In the recording apparatus according to the aspect of the invention, it is preferable that the feeding device be a center feeding type that guides the recording medium near the center.

According to the aspect of the invention, when the feeding device is a center feeding type, the side end position is changed depending on the size of the recording medium, but since the limit position of the recording range is adjusted for each size of the recording medium, it is possible to suppress the deviation of the recording range by the recording unit in any size of the recording medium.

According to another aspect of the invention, there is provided a recording method in the recording apparatus on which a feeding device detachably is mounted for feeding a recording medium, the method includes detecting a side end position in a width direction intersecting with a transport direction of the recording medium fed from the feeding device in a feeding course; calculating a deviation amount between the side end position detected during the detecting of the side end position and a theoretical side end position as an adjustment amount; and adjusting a limit position of a recording range in the width direction in which the recording of the recording unit is permitted by the use of the adjustment amount. According to another aspect of the invention, it is possible to obtain the same effect as the invention relating to the recording apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

FIG. **1** is a perspective view of a printer in an embodiment in which the invention is embodied.

FIG. **2** is a perspective view of the printer of the state in which an exterior case is removed.

FIG. **3** is a schematic side view that describes a feeding and transport system of the printer.

FIG. **4** is a schematic plan view that shows an inner portion of the printer.

FIG. **5** is a block diagram that shows an electrical configuration and a partial functional configuration of the printer.

FIG. **6** is a flow chart that shows a power source-on process routine.

FIG. **7** is a flow chart that shows an ejection starting position calculation routine.

FIG. **8** is a flow chart that shows an additional cassette paper feeding process routine.

FIG. **9** is a flow chart that shows a first side end position detection process routine.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

Hereinafter, an embodiment embodying the invention will be described according to FIGS. **1** to **9**. As shown in FIG. **1**, in a middle lateral length concave region of a rectangular box-shaped main body **12** in a printer **11** as an example of the printing apparatus, a carriage **13** is guided in a guide shaft **14** and is provided in a main scanning direction (left and right direction in FIG. **1**) in a freely reciprocating manner.

As shown in FIG. **1**, in the main body **12**, in a lower position facing the carriage **13**, an elongated plate-shaped support table **15** is disposed. In a front (a front side surface in FIG. **1**) lower portion if the printer **11**, a paper feeding cassette **16** is mounted on a concave target mounting portion **12**A in an insertable and extractable manner. Furthermore, on the back side upper portion of the main body **12**, a paper feeding tray **17** is provided. In the present embodiment, it is possible to perform the switching and the selection between the paper feeding from the paper feeding cassette **16** of the device front portion and the paper feeding from the paper feeding tray **17** of the device back portion.

Furthermore, the printer **11** of the present embodiment has a configuration in which an additional feeding device **18** can be mounted at the lower side of the main body **12** in an attachable and detachable state. FIG. **1** shows the state in which the additional feeding device **18** is mounted at the lower side of the main body **12** of the printer **11**. The additional feeding device **18** is configured so that, in a target mounting portion **18**A recessed in the middle of the width direction, an additional paper feeding cassette **19** (hereinafter, also referred to as an "additional cassette **19**") is mounted in an insertable and extractable manner. As shown in FIG. **1**, in the state in which the additional feeding device **18** is mounted, it is possible to perform the switching and the selection of the paper feeding from the paper feeding cassette **16** of the device front portion, the paper feeding from the additional cassette **19**, and the paper feeding from the paper feeding tray **17** of the device back portion.

Furthermore, in a cover **12**B that covers a right end portion front surface of the main body **12**, a plurality of ink cartridges **20** is loaded. Ink of each ink cartridge **20** is supplied into the carriage **13** through ink supply tubes of a plurality of lines (not shown) that are attached to a flexible wiring plate **21**, respectively. Moreover, ink droplets are ejected (discharged) from a recording head **22** (shown in FIG. **2**) provided in the lower portion of the carriage **13**. In addition, in the recording head **22**, pressing elements (a piezoelectric element, an electrostatic element, a heating element or the like) applying the ejection pressure to the ink are provided for each nozzle, and a predetermined voltage is applied to the pressing element, whereby ink droplets are ejected (discharged) from the corresponding nozzles, respectively. In addition, the loading method of the ink cartridge is not limited to a so-called on-carriage type in which the ink cartridge is loaded on the carriage **13**, but may be a so-called off-carriage type in which the ink cartridge is loaded on a cartridge holder (not shown) provided at the printer main body side.

At the time of the printing, for example, the ink droplets are ejected from the recording head **22** to a paper which is fed from the paper feeding cassette **16** or the additional cassette **19** and is situated on the support table **15** in the course in which the carriage **13** is moved in the main scanning direction, whereby the printing of one line (one row) is performed. After the printing of one line is finished, the paper is transported to the printing position of the next row. In this manner, the printing operation by one scanning of the carriage **13** and the transport operation (the paper feeding operation) of transporting the paper up to the printing position of the next row are alternately repeated, whereby the printing on the paper proceeds. Moreover, the printed paper is discharged onto a three-stage slide type paper discharging tray **23** provided at the upper side of the paper feeding cassette **16**. Herein, the printing operation and the transport operation may be temporally and exclusively performed, but may be performed at the timing at which the other operation is started before one operation is finished, and the mutual operations partially overlap with each other at the same time.

Furthermore, as shown in FIG. **1**, in a place close to the front surface left side of the main body **12**, an operation portion **24** constituted by various operation switches including a power source switch is provided. Furthermore, at an upper surface right side of the main body **12**, a display portion **25** is provided.

Next, a configuration of the printer will specifically be described using FIG. **2**. As shown in FIG. **2**, the printer **11** includes an approximately rectangular box-shaped main body frame **12**C with an opened upper side. The carriage **13**, which is guided to the guide shaft **14** attached to the inner portion of the main body frame **12**C in a main scanning direction (an X direction in FIG. **2**) and can reciprocate, is fixed to an endless timing belt **28** that is wound around a pair of pulleys **26** and **27** disposed on a back plate surface of the main body frame **12**C. A carriage motor (hereinafter, referred to as a "CR motor **29**") connected to one pulley **27** at a driving shaft thereof is driven in a forward and backward rotation direction, whereby the carriage **13** reciprocates in the main scanning direction X.

In the lower portion of the back side of the printer **11**, a rear feeding device **30** is provided which separates only an uppermost sheet of a plurality of papers P stacked on the paper feeding tray **17** and supplies the same to the downstream side in a sub scanning direction Y. In the lower portion of the right side of the main body frame **12**C shown in FIG. **2**, a feeding motor (hereinafter, also referred to as an "ASF motor **31**") and a paper feeding motor (hereinafter, also referred to as a "PF motor **32**") are dispose, respectively.

The ASF motor **31** is driven, whereby among the papers P set in the paper feeding cassette **16** or in the additional cassette **19**, or the papers P stacked on the paper feeding tray **17** on the rear feeding device **30**, an uppermost sheet is fed. Moreover, the PF motor **32** is driven together with the driving of the ASF motor **31**, whereby the paper P is transported (loaded) up to the printing starting position. After the paper P is loaded, by approximately alternately performing the ink ejection operation (the printing operation) of the recording head **22** performed in the course of the reciprocation of the carriage **13** by the driving of the CR motor **29** in the main scanning direction X, and the paper feeding operation which transports the paper P up to the print position of the next row in the sub scanning direction Y the driving of the PF motor **32**, the printing of the image or the like based on the printing data is performed on the paper P.

Furthermore, as shown in FIG. **2**, in the printer **11**, a linear encoder **33**, which outputs a pulse of the number proportional to the movement distance of the carriage **13**, is installed so as to be extended along the guide shaft **14**. The speed control and the position control of the carriage **13** are performed based on the movement position, the movement direction, and the movement speed of the carriage **13** that are obtained by the use of the output pulse of the linear encoder **33**. In addition, immediately below the carriage **13** upon being situated in a home position (a right end position on a carriage movement path in FIG. **2**) in the printer **11**, a maintenance device **34** is provided which performs the cleaning or the like for preventing and solving the nozzle jam or the like of the recording head **22**.

The maintenance device **34** shown in FIG. **2** includes a cap **35** functioning as a cover that prevents the thickening or the drying of ink in the nozzles by coming into contact with a nozzle forming surface **22***a* (see FIGS. **3** and **4**) of the recording head **22**, a wiper **36** for wiping the nozzle forming surface **22***a*, and a suction pump **37**. The cap **35** ascends and descends between a capping position coming into contact with the recording head **22** and a retracted position separated from the recording head **22** by a lifting mechanism **34***a*.

Furthermore, in addition to the cover function (the capping function), the cap **35** also includes the function as a part of a liquid suction unit that caps the nozzle forming surface **22***a* of the recording head **22**, gives an internal space thereof the negative pressure from the suction pump **37**, and forcibly sucks and discharges ink from the nozzles. The waste ink sucked and discharged from the nozzles into the cap **35** is discharged to a waste liquid tank **38** disposed below the support table **15** by the driving of the suction pump **37**.

Next, a mechanism, which performs the paper feeding and the transportation from two paper feeding cassettes **16** and **19**, will be described by the use of FIG. **3**. In the printer **11** of the present embodiment, the control of doing the feeding operation of the subsequent paper P**2** in parallel during the recording operation onto the preceding paper P**1**. In addition, in FIG. **3**, a feeding device of a rear side is omitted.

As shown in FIG. **3**, a front feeding device **40** provided near the bottom portion of the main body **12** of the printer **11** includes a paper feeding cassette **16**, a pickup roller **41**, a middle roller **42**, a retard roller **43**, and an assist roller **44**.

In the paper feeding cassette **16** which can be mounted and removed from the device front side, a plurality of sheets of paper P can be set, and the uppermost one of the set papers P is sent from the paper feeding cassette **16** by a pickup roller **41** driven by an ASF motor **31** (shown in FIG. **2**) one by one. The pickup roller **41** is in the state in which a roller **41**C provided in the tip of a swing member **4**B capable of swinging in the state of being biased to the paper side by a biasing unit (not shown) around a swing shaft **41**A always comes into contact with the uppermost paper.

The paper P to be sent by the pickup roller **41** is preliminarily separated by a separation slope surface **16***a*, and then proceeds to the retard roller **43**. The retard roller **43** is provided in a position facing an outer peripheral surface of the middle roller **42**, and is provided so that it can advance or retreat with respect to the middle roller **42**. The retard roller **43** is brought into pressure-contact with the middle roller **42** to form a nip point, thereby separating the uppermost paper P (the preceding page) to be fed and the paper P after the next page.

The middle roller **42** constituting a transport unit, which sends the paper P fed by the pickup roller **41** to the further downstream side, is driven by the PF motor **32** (shown in FIG. **2**), bends and reverses the paper to be fed, and sends the paper P to the transport roller pair **45** of the downstream side. An assist roller **44** comes into contact with the middle roller **42** to assist the transportation to the paper P by the middle roller **42** to the downstream side.

The transport roller pair **45** includes a transport driving roller **45**A which is rotated and driven by the PF motor **32** (FIG. **2**), and a transport driven roller **45**B which comes into pressure-contact with the transport driving roller **45**A and is subjected to the driven rotation. The transport driving roller **45**A is rotated in the state of being nipped by the transport driving roller **45**A and the transport driven roller **45**B, whereby the paper P, the tip of which reaches the transport roller pair **45**, is transported to the recording portion **46** of the downstream side.

The recording portion **46** shown in FIG. **3** includes the recording head **22** that discharges ink toward the paper P, and the support table **15** that restricts a distance between the paper P and the recording head **22** by supporting the paper P. The recording head **22** is provided in the bottom portion of the carriage **13**, and the carriage **13** is driven so as to reciprocate in the main scanning direction X by the CR motor **29** (shown in FIG. **2**) while being guided in the guide shaft **14** extending in the main scanning direction (a direction perpendicular to the paper surface of FIG. **3**).

A paper discharging roller pair **47** provided at the downstream side (a left side in FIG. **3**) in the transport direction of the recording portion **46** includes a discharge driving roller **47**A that is rotated and driven by the PF motor **32** (FIG. **2**), and a discharge driven roller **47**B that is subjected to the driven rotation while coming into contact with the discharge driving roller **47**A. The discharge driving roller **47**A is rotated and driven in the state of being nipped by the discharge driving roller **47**A and the discharge driven roller **47**B, whereby the paper P recorded by the recording portion **46** is discharged to the paper discharging tray **23** provided at the device front side. In addition, in the present embodiment, the transport unit is constituted by the PF motor **32**, the transport roller pair **45**, the paper discharge roller pair **47** or the like.

Meanwhile, the additional front feeding device **18** includes the additional cassette **19**, the pickup roller **48**, and the feeding roller pair **49**. Furthermore, a feeding roller pair **50** is also provided at the main body **12** side. The additional feeding device **18** is electrically connected to a terminal of the main body **12** side by being mounted on the bottom surface of the main body **12**, and is connected so that it can transmit the power of the ASF motor **31** and the PF motor **32** to the pickup roller **48** and the feeding roller pair **49**.

The pickup roller **48** is configured so that a roller **48**C provided in the tip of the swing member **48**B capable of swinging in the state of being biased to the paper side by a biasing unit (not shown) around the swing shaft **48**A always comes into contact with the uppermost paper. The power of the ASF motor **31** is transmitted via a power transmitting mechanism (not shown), whereby the roller **48**C of the pickup roller **48** is rotated.

The feeding roller pair **49** in FIG. **3** includes a feeding driving roller **49**A that is rotated and driven by the ASF motor **31** (FIG. **2**), and a feeding driven roller **49**B that is subjected to the driven rotation while coming into contact with the feeding driving roller **49**A. The feeding driving roller **49**A is rotated in the state of being nipped by the feeding driving roller **49**A and the feeding driven roller **49**B, whereby the paper P, the tip of which reaches the feeding roller pair **49**, is transported to the main body **12** side.

Furthermore, the feeding roller pair **50** of the main body **12** side shown in FIG. **3** includes a feeding driving roller **50**A that is rotated and driven by the PF motor **32** (FIG. **2**), and a

feeding driven roller **50**B that is subjected to the driven rotation while coming into contact with the feeding driving roller **50**A. The feeding driving roller **50**A is rotated in the state of being nipped by the feeding driving roller **50**A and the feeding driven roller **50**B, whereby the paper P, the tip of which reaches the feeding roller pair **50**, is transported to the retard roller **43** side.

The paper P fed by the pickup roller **48** in the additional cassette **19** is preliminarily separated by a separation slope surface **19***a*, and proceeds between the middle roller **42** and the retard roller **43** while being nipped by the feeding roller pair **49** and **50**. If the paper is fed in an overlapped manner, in the nip point between the retard roller **43** and the middle roller **42**, the uppermost paper P (the preceding page) to be fed and the paper P after the next page are separated from each other. The paper transported from the additional cassette **19** to the retard roller **43** is then transported to the transport roller pair **45** by the use of a part of the feeding device **40**.

In a predetermined position between the assist roller **44** and the transport roller pair **45** on the paper transport path, a paper detection sensor **51** is disposed. The paper detection sensor **51** is situated so as to face the transport path of the paper P fed and transported from the paper feeding cassettes **16** and **19** side, and is configured so that it can detect the tip and the rear end of the paper P. The paper detection sensor **51** detects the tip of the paper P so that the detection state thereof is switched from "paper absence" to "paper presence", and detects the rear end of the paper P so that the detection state thereof switched from "paper presence" to "paper absence".

In the printer **11** of the present embodiment, in a high speed printing mode (a draft printing mode) of a plurality of printing modes, when the preceding paper P**1** is transported to a prescribed position, even in the process of printing, the paper feeding control of starting the feeding of the subsequent paper P**2** is performed. For this reason, as shown in FIG. **3**, when a sensor (not shown) detects that the rear end of the preceding paper P**1** reaches the prescribed position, the pickup rollers **41** or **48** are driven to start the feeding of the subsequent paper P**2**. Moreover, when a sensor (not shown) detects that the tip of the subsequent paper P**2** reaches a standby position which can ensure a predetermined gap between the tip and the rear end of the preceding paper P**1**, the driving of the pickup roller **41** or **48** is stopped. Moreover, after that, when the preceding paper is transported, the preceding paper and the subsequent paper are simultaneously transported in parallel while holding a predetermined gap.

The carriage **13** is provided with a paper width detector **52** in the position of the upstream side in the transport direction from the recording head **22**. The paper width detector **52** includes a transmission type optical sensor that performs the detection, for example, when light is blocked by the paper, or a reflection type optical sensor that detects light reflected by the surface of the paper. The paper width detector **52** detects both side end positions (both side end positions) of the paper P in the width direction (the main scanning direction X). Moreover, the paper width is obtained based on the respective detection results of the paper width detector **52**.

Next, a configuration will be described which obtains the ejection starting position of the recording head **22**, by the use of FIG. **4**. In addition, in FIG. **4**, a part is shown in a cross section so that the additional cassette **19** is viewed. In FIG. **4**, a position (an alternate long and short dash line in FIG. **4**) of the carriage **13** when the recording head **22** and the cap **35** coincide to each other in the main scanning direction X is a home position HP. The position (that is, the carriage position) of the carriage **13** in the main scanning direction X setting the home position Hp as an original point is acquired by counting the detection pulse of the linear encoder **33**.

The linear encoder **33** includes a tape-shaped code disc **33***a* (a linear scale) formed with a plurality of slits for each certain pitch (for example, 1/180 inches (=1/(180×2.54) cm)), and a sensor **33***b* having a light emitting element and a light reception element provided in the carriage **13**, and has a configuration in which the light reception element receives light emitted from the light emitting element and passed through the slit when the carriage **13** is moved, whereby the sensor **33***b* outputs the detection pulse. For example, the pulse edge of the detection pulse (two pulses of an A phase and a B phase having a phase deviation of 90°), which is input from the linear encoder **33**, is counted, and the carriage position is obtained from the counted value.

As shown in FIG. **3**, the carriage position is defined so that, as the carriage **13** is situated at a counter-position side (a left side in FIG. **3**) setting the original point in the home position HP as "0", the numerical value is increased. In addition, in the present embodiment, in the movement path of the carriage **13**, the home position HP side is also called a "1 digit side", and the counter-home position side is also called "80 digit sides".

As shown in FIG. **4**, in the bottom portion of the additional cassette **19**, a paper guide **53** capable of realizing the center paper feeding is provided. Herein, the center paper feeding refers to a mode in which the paper feeding is performed while guiding the paper in the width direction (the main scanning direction X) so that the width center of the paper is always in the same position (a center position Xc) even in the different paper sizes. The paper guide **53** includes a pair of movable guide portions **53**A and **53**B that are able to guide both ends (both side ends) of the paper P in the width direction accommodated in the additional cassette **19**. The pair of movable guide portions **53**A and **53**B is configured so as to be slidable while taking the bilateral symmetrical position in the main scanning direction X with respect to the center position Xc.

As shown in FIG. **4**, in the paper P (the paper during transportation in FIG. **4**) fed from the additional cassette **19** while being guided to the pair of movable guide portions **53**A and **53**B, the width center thereof coincides with the center position Xc regardless of the paper sizes. Since the other paper feeding cassette **16** also includes the same paper guide **53** and the paper is guided to the pair of movable guide portions **53**A and **53**B in the width direction, the center paper feeding is similarly performed in the other paper feeding cassette **16**. Furthermore, in the paper feeding tray **17** of the rear side, since the paper is similarly guided to the pair of movable guide portions, the center paper feeding is possible.

In the center paper feeding method, the design (theoretical) side end position of the paper is set for each paper size. Herein, based on the design side end position of the paper, the ejection starting position allowing the starting of the ink ejection from the recording head **22** may be determined. However, the ejection starting position is determined depending on an actual side end position of the paper in consideration of the mounting position in the main scanning direction X when the detachable additional cassette **19** is mounted on the main body **12**. In the present embodiment, upon obtaining the ejection starting position, a design (theoretical) first side end position Xsn in the main scanning direction X is defined for each paper size.

In the example shown in FIG. **3**, the first design side end position Xsn is defined by formula Xsn=Xc−PW/2 by the use of the center position Xc and a paper width PW determined from information of the paper size at that time. If the paper size is defined in this manner, it is possible to obtain the first

design side end position Xsn by the calculation for each paper size. Moreover, the ejection starting position can be obtained from the printing set information and the side end position concerning the layout such as a margin amount or presence or absence of the borderless printing.

In the paper feeding cassette **16**, the position deviation of the mounting position is hardly generated with respect to the main body **12** in the main scanning direction X (the paper width direction). Moreover, since the setting amount ΔB relative to the first side end position is defined by the use of the layout information such as the margin amount or presence or absence of the borderless printing that is set as the printing set information, the ejection starting position is obtained by adding the setting amount ΔB to the first side end position.

As shown in a right bottom in FIG. **3**, on the nozzle forming surface **22***a* of the recording head **22**, a plurality (for example, four) of nozzle rows **22***b* is arranged along the paper transport direction Y. The respective nozzle rows **22***b* are constituted by, for example, 180 nozzle groups that are disposed along the Y direction in a zigzag manner. The plurality of nozzle rows **22***b* of the recording head **22** is permitted to start to eject the ink droplets upon coinciding with the ejection starting position Xst (for example, Xst=Xd**1**), respectively.

A switching holding device **55** includes a lever type power switching member **56** which is engaged in the movement course, before the carriage **13** reaches the home position HP, is able to perform the pushing operation, and is switched by operating the power switching member **56** by the carriage **13**. The switching holding device **55** selects one of the rear feeding device **30**, the front feeding device **40**, and the additional feeding device **18** as the power transmission place of the ASF motor **31**, depending on the disposition position of the carriage **13**.

The first side end position of the home position HP side (one digit side) of the paper P during printing in the width direction (the X direction) is changed depending on the paper sizes of the paper P to be guided to the pair of guides **53**A and **53**B. A value Xd**1** of a first paper end position is indicated as a value (a distance) from the home position HP (the original point O). Furthermore, when setting a value expressing the width (the width of the X direction) of the paper P to PW, a second side end position Xd**2** of the counter-home position side (80 digit side) of the paper P is indicated by Xd**2**=Xd**1**+PW.

Furthermore, the rear feeding device **30** includes a paper feeding roller **30**A, and the paper feeding roller **30**A is rotated and driven based on the driving force of the ASF motor **31** transmitted via the switching holding device **55** and feeds only an uppermost sheet of the papers P set on the paper feeding tray **17** during paper feeding. Moreover, it is configured so that the tip of the fed paper P is detected by the paper detection sensor **51** situated at the upstream side of the transport direction further than the recording head **22**.

Furthermore, the paper width detector **52** moving with the carriage **13** detects the "paper presence" when the light receptor receives the reflected light generated by the reflection of light emitted from a projector by the paper P, and detects the "paper absence" when the paper P is absent and the reflected light cannot be received by the light receptor. Moreover, the side end position of the paper P is detected from the position of the carriage **13** when being switched from the "paper presence" to the "paper absence". Of course, the paper width detector **52** may be a transmission type. Furthermore, the paper width detector **52** may have a configuration that detects the paper, when a reflection mirror is installed at an opposite side with the paper transport path interposed therebetween, the reflected light reflected by the reflection mirror is blocked by the paper and light cannot be received.

Next, an electrical configuration of the printer **11** will be described based on FIG. **5**. As shown in FIG. **5**, a host device **100** is connected to the printer **11** in a communicatable manner. The host device **100** is constituted by, for example, a personal computer, a portable terminal or the like, and is equipped with a printer driver (not shown). The printer driver creates the printing data from the image data of the printing target, and sends (transmits) the printing data to the printer **11**. At this time, the printer driver performs a predetermined image process such as a resolution conversion process, a color conversion process, a halftone process, a rasterize process on the image data, and creates the printing image data of CMYK color base.

Furthermore, when performing the printing, a user inputs the printing set information (the printing condition information) to the host device **100**. The printing set information includes paper type, paper size, printing quality (high quality (photography printing)/standard/low quality (draft mode printing or the like)), printing color (color/gray scale) or the like. The printer driver adds a command described as a printing language and partial printing set information including at least the printing size to the printing image data, and creates the printing data. Moreover, the printer driver transmits the created printing data to the printer **11**.

As shown in FIG. **5**, the printer **11** includes a controller **60**, and an interface (hereinafter, referred to as am "I/P **61**"), includes the CR motor **29**, the ASF motor **31**, the PF motor **32** as a driving system, and includes the linear encoder **33**, the paper detection sensor **51**, and the rotary encoder **62** as a detection system. Furthermore, the printer **11** includes an ASF motor driving circuit **63** for driving and controlling the respective motors **29**, **31**, and **32** of the driving system, a PF motor driving circuit **64**, a CR motor driving circuit **65**, and a head driving circuit **66** for driving and controlling the recording head **22**. Furthermore, the printer **11** includes an operation portion **24** and a display portion **25**. In addition, the printer **11** is provided with an additional cassette detection sensor (hereinafter, simply referred to as an "additional detection sensor **67**") which detects that the additional feeding device **18** (in other words, an additional cassette **19**) is mounted on the main body **12**.

The printer **11** receives the printing data from the host device **100**, for example, a personal computer or the like) via the I/F **61**. The received printing data is acquired to the controller **60**.

The controller **60** is equipped with a computer **70**. The computer **70** includes a CPU, a ROM, a RAM, a nonvolatile memory or the like, and further includes an ASIC (Application Specific IC) as necessary. Moreover, the computer **70** has various functional portions that are realized by software realized by the execution of the program memorized in the ROM or the nonvolatile memory by the CPU, and hardware realized by various electronic circuits of the ASIC as necessary. In FIG. **5**, in the computer **70**, various functional portions are shown. That is, the computer **70** includes a control portion **71**, a buffer **72**, an image process portion **73**, and a head control portion **74**. The buffer **72** is constituted, for example, by the use of a partial memory region of the RAM.

Next, the respective portions **71** to **74** constituting the computer **70** will be described.

The printing data acquired from the host device **100** via the I/F **61** is temporarily stored in the buffer **72**. The control portion **71** reads the command of the printing data stored in

the buffer **72**, interprets the command, and drives and controls of various motors **29**, **31**, and **32** according to the instruction of the interpreted command.

The image process portion **73** reads the printing image data (a raster data) of the printing data from the buffer **72** and performs the required image process. As a result, the head control data of the data form is created, which can be used in the control of the recording head **22** by the head driving circuit **66**. The image process portion **73** sends the created head control data to the head control portion **74**. The head control portion **74** transmits the head control data to the head driving circuit **66** while adjusting the timing together with the control portion **71**. The head driving circuit **66** performs the ink ejection control of the recording head **22** by driving the ejection driving element provided for each nozzle in the recording head **22** based on the control data.

Furthermore, the control portion **71** also performs the display control of the display portion **25** in addition to governing various controls of the feeding system, the transport system, and the carriage driving system. In order to perform such a control, as shown in FIG. **5**, the control portion **71** includes a main control portion **81**, a feeding control portion **82**, a transport control portion **83**, a carriage control portion **84**, a CR counter **85**, and a PF counter **86**. The main control portion **81** issues various instructions required for the printing control to the feeding control portion **82**, the transport control portion **83**, and the carriage control portion **84**.

The feeding control portion **82** drives and controls the ASF motor **31** via the ASF motor driving circuit **63**, and performs the feeding control of the paper. At this time, depending on the disposition position of the carriage **13** as the power transmission place of the ASF motor **31**, the switching holding device **55** selects one of the rear feeding device **30**, the front feeding device **40**, and the additional feeding device **18**. Furthermore, the transport control portion **83** drives and controls the PF motor **32** via the PF motor driving circuit **64**, and performs the transport control (the paper feeding control) of the paper. Furthermore, the carriage control portion **84** drives and controls the CR motor **29** via the CR motor driving circuit **65**, and controls the movement of the carriage **13** in the main scanning direction X.

The CR counter **85** counts the edges of two pulse signals ES**1** and ES**2** having the phase deviation of 90° that are input from the linear encoder **33** when the carriage is driven. The CR counter **85** increments the counted value when the carriage **13** is moved forward from the home position toward **80** digit side, and decrements the counted value when the carriage **13** is moved backward toward the home position (one digit side), thereby managing the movement position of the carriage **13**.

The PF counter **86** manages the counted value depending on the transport position of the paper P by counting the edges of the pulse signals ES**3** and ES**4** that are input from the rotary encoder **62**. Specifically, when the paper detection sensor **51** detects the tip of the paper P, the PF counter **86** is rest, and then, when the tip of the paper P reaches the head standard position, the paper detection sensor **51** is rest again. The counted value after the further rest indicates the transport position of the paper which sets the time when the tip of the paper reaches the head standard position as an original point. In addition, as shown in FIG. **5**, the rotary encoder **62** has a code disc **62***a* that is fixed to an end portion of a shaft portion (for example, a shaft portion of the transport driving roller **45**A) connected to the PF motor **32** in a power transmissible manner, and a sensor **62***b* that receives light transmitted through the slit of the code disc **62***a* and outputs two pulse signals ES**3** and ES**4** having the phase deviation of 90°.

Furthermore, the control portion **71** includes a display control portion **87**, a calculation portion **88**, a first determination portion **89**, a second determination portion **90**, a third determination portion **91**, and a memory **92**. The display control portion **87** performs the display control of displaying various menus or the content of an error when the error is generated on the display portion **25**.

In the memory **92** (for example, a nonvolatile memory), information of the center position Xc is memorized. Furthermore, various flags are memorized in the memory **92**. In the present embodiment, a paper end detection flag F**1** and a limit determination flag F**2** for the additional cassette are set. The paper end detection flag F**1** is a flag for determining whether or not the paper end detection is performed in the first page of the initial printing by the paper feeding from the additional cassette **19** after the power source is turned on. The paper end detection flag F**1** is set to "1" when the power source is turned on, and when the ejection starting position adjustment amount ΔX is set in the first page of the initial printing by the paper feeding from the additional cassette **19** after the power source is turned on, the paper end detection flag F**1** is considered as "0". The paper end detection flag F**1** is used in the determination by the first determination portion **89**. Furthermore, the memory **92** is also used as a memory region that preserves the calculation result of the calculation portion **88**.

The calculation portion **88** performs various calculations that include the calculation of the first design side end position Xsn or the ejection starting position. Furthermore, the calculation portion **88** calculates a deviation amount ΔX (=|Xd**1**−Xsn|) between the first side end position Xd**1** that is actually detected by the paper width detector **52** and the first design side end position Xsn depending on the paper size of that time. At this time, as the paper size, one of the printing set information contained in the printing data is used, and the first design side end position Xsn (=Xc−PW/2) is acquired by the use of the paper width PW defined by the paper size and information of the center position Xc read from the memory **92**. In the present embodiment, an example of the acquisition unit is constituted by the calculation portion **88** that calculates the first design side end position Xsn. Furthermore, the calculation unit is constituted by the calculation portion **88** that calculates the deviation amount ΔX (that is, the ejection starting position adjustment amount).

The first determination portion **89** determines whether or not the paper is fed from the additional cassette **19** and "1" is set in the paper end detection flag F**1** for the additional cassette. That is, the first determination portion **89** determines whether or not the paper end detection of the first page of the initial printing by the paper feeding from the additional cassette **19** is performed after the power source is turned on. If the flag F**1** is "1", It is determined that the paper end detection of the first page of the initial printing after the power source-on by the paper feeding from the additional cassette **19** is not performed, and meanwhile, if the flag F**1** is "0", it is determined that the paper end detection of the first page of the initial printing after the power source-on by the paper feeding from the additional cassette **19** is performed in advance.

However, even when the additional feeding device **18** is mounted after the power source is turned on, the initial printing by the printing from the additional cassette **19** after the detection of the feeding device **18** is treated as the initial printing by the paper feeding from the additional cassette **19** after the power source is turned on. This is because, when the additional feeding device **18** is mounted, since the on signal is input from the additional cassette detection sensor **67**, the paper end detection flag F**1** is set to "1". In this manner, when the feeding device **18** is mounted after the power source is

turned on, it is determined whether or not the paper end detection of the first page of the case of performing the initial printing after the mounting is performed.

The second determination portion **90** performs the error determination. The content of the determined error is a paper jam error, a document loading error or the like. When the second determination portion **90** determines the error, the indication is notified to the display control portion **87**. The display control portion **87** displays the error content on the display portion **25** and notifies a user of the indication of the error occurrence.

The third determination portion **91** determines whether or not the deviation amount |ΔX| (=|Xd**1**−Xsn|) between the first side end position Xd**1** detected by the paper width detector **52** and the first design side end position Xsn is equal to or less than a predetermined limit value L (|ΔX|≤L). Herein, when the limit value L is the deviation amount |ΔX| exceeding this value, the limit value L is set to a value to be determined that there is a high possibility that the paper set positions in the additional cassette **19** deviate in the width direction by a prescribed amount or more. The deviation amount ΔX exceeding the limit value L is not adopted as the ejection starting position adjustment amount. An upper limit or a lower limit of the ejection starting position adjustment ΔX is up to the limit value (L or −L).

Next, an action of the printer **11** will be described based on the flow chart shown in FIGS. **6** to **9**.

Firstly, when the power source is input by operating the operation portion **24** of the printer **11**, the CPU in the computer **70** executes the power source-on routine process shown in FIG. **6**. Firstly, in step S**11**, it is determined whether or not the additional cassette **19** is mounted. That is, from the additional detection sensor **67**, it is determined whether or not the on-signal, which indicates that the additional feeding device **18** is mounted, is input. If the additional cassette **19** is mounted, "1" is set to the paper end detection flag F**1** for the additional cassette. Meanwhile, if the additional cassette **19** is not mounted, the paper end detection flag F**1** for the additional cassette is set to "0".

Next, when a user performs the operation for printing the printing target such as a document or an image by an input device, the printer driver is started, and the set screen is displayed on a monitor of the host device **100**. A user inputs the printing set information including the paper size in the set screen. After that, when a user performs the operation of instructing the execution of the printing, the printer driver creates the printing data from the image data of the printing target, and transmits the same to the printer **11**. At this time, the printing data transmitted to the printer **11** includes information of the paper size.

In the printer **11** receiving the printing data, the computer **70** performs the printing process based on the printing data. The computer **70** selects the used paper feeding cassette based on information of the specified paper size. For example, when the specified paper size is the same as the paper size of the paper P accommodated in the additional cassette **19**, the additional cassette **19** is selected. When the additional cassette **19** is selected, the computer **70** performs the feeding process according to the additional cassette paper feeding process routine shown in FIGS. **8** and **9**. Hereinafter, the additional cassette paper feeding process will be described based on FIGS. **8** and **9**.

Firstly, in step S**21** in FIG. **8**, the paper is transported (fed) up to a roller nipping position. Herein, the roller biting position means that the paper P is fed up to a position where the tip of the paper P is pinched (nipped) by the transport roller pair **45** for the skewing of the paper, that is, a position (the roller biting position) where the transport roller pair **45** is bitten to the tip of the paper P.

Moreover, in next step S**22**, it is determined whether or not the paper can be transported to the roller biting position. Herein, after the PF counter **86** is reset when the tip of the paper P is detected by the paper detection sensor **51** while being fed up to the roller biting position, the transport position of the paper setting the detection position as the original point is counted by the PF counter **86**. A distance between the paper detection sensor **51** and the transport roller pair **45** is known. For that reason, in step S**22**, it is determined whether or not the count value of the PF counter **86** reaches a value corresponding to a value of the roller biting position. Moreover, if the count value of the PF counter **86** reaches the value corresponding to the roller biting position, it is determined that the paper can be transported up to the roller biting position. Furthermore, despite the fact that the rotation amount or the driving time from the driving start time of the ASF motor **31** exceeds a threshold value that is set to a value longer than the rotation amount or the time required for transporting the tip of the paper to the roller biting position, in a case where the paper detection sensor **51** does not detect the tip of the paper P, it is determined that a feeding error is generated in which the paper cannot be transported up to the roller biting position. The determination of the feeding error is performed by the second determination portion **90**. Moreover, when the paper can be transported up to the roller biting position, the process proceeds to step S**23**, and when the paper cannot be transported up to the roller biting position, the process proceeds to step S**31**.

Herein, a case where the paper cannot be transported up to the roller biting position includes the case of the paper absence where the paper is not accommodated in the additional cassette **19**, and a case where the paper jam is generated in which the fed paper is jammed on the way. In step S**31**, an error display indicating the paper absence or the paper jam is performed on the display portion **25**. The display process is performed by a display control portion **87** that receives the notification of the error determination result by the second determination portion **90**. In addition, the paper transported up to the roller biting position forms a flexure at the tip portion side by the inversion of the transport roller pair **45**, and the skew of the paper P is removed when the transport roller pair **45** is rotated in the forward direction again and the flexure is opened.

In step S**23**, it is determined whether or not the paper is fed from the additional cassette **19** and the paper end detection flag F**1**=1. Since the paper is the first page in the initial printing (the printing operation) after the power source is turned on (the power supply activation), the paper end detection flag, which is set after the power source is turned on, is in the state of F**1**=1. Furthermore, the paper is fed from the additional cassette **19**. Thus, the determination condition in step S**23** is established, the process proceeds to step S**24**. In addition, when the paper feeding cassette **16** other than the additional cassette **19** or the paper feeding tray **17** of the rear side is selected, when the paper end detection flag F**1** is a value "0" obtainable after going through the process of step S**26**, the processes of the steps S**25** to S**28** are omitted, and the process proceeds to step S**29**.

In step S**24**, a paper tip position detection process is performed. That is, the carriage **13** is moved to a predetermined position near the center position Xc, and the paper is transported from the skewing completion position to a predetermined position where the tip exceeds the detection target position of the paper width detector **52** in the transport posi-

tion while causing the carriage **53** to wait in the position. As a consequence, the tip of the paper P is detected by the paper width detector **52**. The counted value of the PF counter **86** when being detected by the paper width detector **52** is acquired as the tip detection position. The paper tip detection position is used in the loading of the paper P.

In next step S**25**, it is determined whether or not the paper tip position can be detected. That is, despite the fact that the PF motor **32** is driven by a sufficient rotation amount or for a driving time so as to transport the paper P up to the detection target position of the paper width detector **52**, it is determined whether or not the paper width detector **52** detects the position. When the paper tip position can be detected, the process proceeds to step S**26**, and when the paper tip position cannot be detected the process proceeds to step S**32**. Herein, the case where the paper tip position cannot be detected includes a case where the paper jam is generated while the paper is transported up to the detection target position of the paper width detector **52**. For that reason, in step S**32**, the paper jam error is displayed on the display portion **25**.

Meanwhile, when the paper tip position can be detected, in step S**26**, the first side end position detection process is performed. In the step S**26**, specifically, the first side end position detection process routine shown in FIG. **9** is performed. Hereinafter, the first side end position detection process will be described based on FIG. **9**.

Firstly, in step S**41**, the first design side end position Xsn is calculated. That is, the calculation portion **88** calculates the first side end position Xsn by the formula Xsn=Xc−PW/2. Herein, Xc is a design center position (a width center position) of the paper in the width direction, and PW is a paper width. The paper width PW is obtained from information of the paper size, for example, with reference to the table.

In next step S**42**, the first side end of the paper is detected by the paper width detector **52**. That is, the carriage **13** is moved from a predetermined position near the center during paper tip position detection process toward an object position near the home position HP. The object position is determined to a position where the paper width detector **52** can reliably pass through the first side end of the paper, depending on the paper size of that time. While the carriage **13** is moved up to the object position, the paper width detector **52** detects the first side end.

In next step S**43**, it is determined whether or not the first side end can be detected. When the first side end can be detected, the process proceeds to step S**44**, and when the detection is impossible, the process proceeds to step S**45**. Herein, a case where the paper width detector **52** cannot detect the first side end includes a case where the paper is abnormally significantly deviated in the width direction or a case where the paper width detector **52** cannot detect the reflected light from the paper P owing to the deep color of the paper.

When the first side end can be detected, in step S**44**, the detection position is set to the first side end position Xd**1**. Meanwhile, when the first side end cannot be detected, in step S**45**, the first design side end position Xsn is set as the first side end position Xd**1**. After the first side end position Xd**1** is set in step S**44** or S**45**, the process proceeds to step S**46**.

In step S**46**, it is determined whether or not the paper is fed from the additional cassette **19** and the paper end detection flag F**1**=1. Since the paper is the first page in the initial printing (the printing operation) after the power source is turned on (the power supply activation), the paper is fed in the paper end detection flag F**1**=1, which is set when the power source is turned on, from the additional cassette **19**. Thus, since the determination condition in step S**46** is established this time, the process proceeds to step S**47**. In addition, when the paper feeding cassette **16** other than the additional cassette **19** or the paper feeding tray **17** of the rear side is selected, or when the paper end detection flag F**1** is a value "0" obtainable after finishing the process of step S**49** in the routine, the routine is finished.

In step S**47**, the limit determination flag F**2** is set to "0" (F**2**=0).

Moreover, in next step S**48**, it is determined whether or not |Xd**1**−Xsn|≤L. That is, the third determination portion **91** calculates an absolute value of a difference between the first side end position Xd**1** and the first design side end position Xsn, that is, an absolute value of the deviation amount ΔX, and it is determined whether or not the absolute value is equal to or less than the limit value L. In other words, it is determined whether or not the deviation amount ΔX=Xd**1**−Xsn is within the scope of −L≤ΔX≤L. When the formula |Xd**1**−Xsn|≤L is established, the process proceeds to step s**49**, and when the formula is not established, the process proceeds to step S**50**.

In step S**49**, ΔX=Xd**1**−Xsn is set as the ejection starting position adjustment amount ΔX. That is, the deviation amount between the first side end position Xd**1** and the first design side end position Xsn is set as the ejection starting position adjustment amount ΔX.

Meanwhile, in step S**50**, the limit determination flag F**2** is set to "1" (F**2**=1). F**2**=1 means that |Xd**1**−Xsn| exceeds the limit value L. For example, when the paper set position in the additional cassette **19** deviates in the width direction, in some cases, |Xd**1**−Xsn| exceeds the limit value L. For this reason, in a case where there is a possibility that the deviation of the paper set position in the additional cassette **19** is a cause, the ejection starting position adjustment amount ΔX is limited to the limit value L.

For this reason, in step S**51**, it is determined whether or not Xd**1**−Xsn≥0 is established. By the determination of Xd**1**−Xsn≥0, it is determined whether the first detected side end position Xd**1** deviates to a positive side (a counter home position side) (a condition establishment) or deviates to a negative side (a home position side) (a condition non-establishment), with respect to the first design side end position Xsn. When Xd**1**−Xsn≥0 is established, the process proceeds to step S**52**, and when Xd**1**−Xsn≥0 is not established, the process proceeds to step S**53**.

In step S**52**, ΔX=L is set as the ejection starting position adjustment amount ΔX. That is, the ejection starting position adjustment amount ΔX is limited to the limit value L.

Furthermore, in step S**53**, ΔX=−L is set as the ejection starting position adjustment amount ΔX. That is, the ejection starting position adjustment amount ΔX is limited to the limit value L.

Moreover, when the setting (the calculation) of the ejection starting position adjustment amount ΔX is finished, in step S**54**, it is determined whether or not the limit determination flag F**2** is "0" (F**2**=0). If F**2**=0, the process proceeds to step S**55**, and the paper end detection flag F**1** is set to "0" (F**1**=0). Meanwhile, if F**2**=1, the routine is finished. When F**1**=0, the resetting of the ejection starting position adjustment amount is not performed, and the ejection starting position adjustment amount ΔX set this time is used until the power source is turned off (the power source is blocked). Meanwhile, when F**1**=1, after the next time, the ejection starting position adjustment amount ΔX is reset. The first side end position detection process is finished as mentioned above.

Returning to FIG. **8**, in next step S**27**, the second side end position detection process is performed. That is, the carriage **13** is moved from the position where the first side end position

detection process is finished to the object position of the counter-home position side. The object position can be determined in the position where the paper width detector **52** can reliably pass through the second side end of the paper, depending on the paper size of that time. While the carriage **13** is moved up to the object position, the paper width detector **52** detects the second side end of the paper width detector **52**.

In next step S**28**, it is determined whether or not both side end positions of the paper can be detected. When both side end positions of the paper can be detected, the process proceeds to step S**29**, and when both side end positions cannot be detected, the process proceeds to step S**32**. Herein, the case where both side end positions of the paper cannot be detected includes a case where the paper jam is generated. For this reason, in step S**32**, the error display indicating the paper jam is performed on the display portion **25**.

Meanwhile in step S**29**, the paper is transported up to the printing starting position. That is, the loading of the paper is performed.

Moreover, in next step S**30**, it is determined whether or not the paper can be transported up to the printing starting position. When the paper can be transported up to the printing starting position, the routine is finished. Meanwhile, when the paper cannot be transported up to the printing starting position, the process proceeds to step S**33**, and the indication of the paper feeding error is displayed on the display portion **25**.

In this manner, in the first page of the initial printing in the paper feeding from the additional cassette **19** after the power source is turned on, if the feeding error is not generated, the ejection starting position adjustment amount ΔX is set. In the ejection starting position adjustment amount ΔX, when $|Xd1-Xsn| \leq L$ is established, $\Delta X=Xd1-Xsn$ is set. Meanwhile, when $|Xd1-Xsn| \leq L$ is not established, $\Delta X=L$ or $\Delta X=-L$ is set. Moreover, when $\Delta X=Xd1-Xsn$ is set, the paper end detection flag is renewed to F**1**=0, but when $\Delta X=L$ or $\Delta X=-L$ is set, the paper end detection flag F**1**=1 is not renewed.

In this manner, when the ejection starting position adjustment amount ΔX is set, then, the computer **70** performs the ejection starting position calculation routine shown in FIG. **7**.

Firstly, in step S**61**, a setting amount ΔB of the ejection starting position to the first design side end position Xsn is acquired. The setting amount ΔB is an adjustment value that is defined based on the layout information (the margin information of the width direction, presence or absence of the borderless printing or the like) of the printing set information. The setting amount ΔB is, for example, acquired as a piece of information in the header of the printing data calculated by the printer driver, or is acquired by the calculation of the calculation portion **88** on the basis of the layout information as a piece of information in the header of the printing data. The setting amount ΔB is given as the adjustment value from the side end position of the paper. For example, when a margin amount B mm of the width direction is set, the setting amount is given as a value in which the margin is ensured (for example, ΔB=B mm). When the borderless printing is set, the setting amount is given as a value of a predetermined distance G mm (for example, 1 to 3 mm) at the outside (the negative side) of the side end position so that the borderless printing is reliably performed (for example, ΔB=−G mm).

In next step S**62**, an ejection starting position Xst is calculated. That is, the ejection starting position Xst is calculated by formula Xst=Xsn+ΔX+ΔB. Before the paper is loaded to the printing starting position and the printing of first pass (first line) is started, the ejection starting position Xst is obtained. Moreover, in the process during which the carriage **13** is moved from the home position HP side by the first pass, when the nozzle row **22***b* reaches the carriage position that coincides with the ejection starting position Xst, an ejection permission signal is output which permits the ejection of the ink droplet from the control portion **71** to the head control portion **74**. When the ejection permission signal is input, the head control portion **74** sends the ejection starting permission signal to the head driving circuit **66**. When the ejection starting permission signal is input, the head driving circuit **66** starts the ejection control of the ink droplet of the recording head **22** based in the head control data.

In this manner, after that, the printing for each pass is repeated on the basis of the set ejection starting position Xst, and the printing on the paper P is performed. Herein, the printing method includes a one-way printing method of performing the printing only in a forward movement course in which the carriage **13** is moved from the home position side to the counter-home position side, and a bidirectional printing method of performing the printing even in a backward movement course in which the carriage **13** is moved from the counter-home position side to the home position side, in addition to the printing of the forward movement course, depending on the printing mode. In the case of the bidirectional printing method, the ejection starting position Xst of the forward movement course is calculated by formula Xst=Xsn+PW+ΔX−ΔB, for example, by the use of the first design side end position Xsn, the paper width PW, the ejection starting position adjustment amount ΔX, and the setting amount ΔB of the second side end position side. Of course, the ejection starting position Xst of the backward movement course may be calculated by the use of the second side end position Xd**2** acquired in the second side end position detection process (S**27**).

In this manner, when the printing of a plurality of passes is performed by one-way printing method or the bidirectional printing method and the printing of the first page is finished, the printed paper P is discharged. Moreover, if a plurality of sheets is printed, the paper of the second page is fed from the additional cassette **19**. During feeding, in the same manner as the first page, the additional cassette paper feeding process shown in FIGS. **8** and **9** is performed.

For example, in the paper feeding process of the first page, when the ejection starting position adjustment amount ΔX is set, since the paper end detection flag is F**1**=0, in step S**23** in FIG. **8**, the determination condition is not established in which the paper is fed from the additional cassette **19** and the paper end detection flag F**1**=1. For this reason, after performing the skewing (S**21**) in the feeding process, the paper end detection processes (S**24** to S**28**) are omitted, and the paper is transported up to the printing starting position in step S**29**. That is, the resetting (S**26**) of the ejection starting position adjustment amount ΔX is not performed, and the ejection starting position adjustment amount ΔX is used which is set at the time of the feeding of the first page.

Meanwhile, in the paper feeding process of the first page, even if the ejection starting position adjustment amount ΔX is set, when that is the limit value ($\Delta X=L$ or $\Delta X=-L$), the paper end detection flag F**1**=1. Thus, in step S**23** in the feeding course of the second page, the determination condition in which the paper is fed from the additional cassette **19** and the paper end detection flag F**1**=1. For this reason, in the feeding course of the second page, step S**26** of FIG. **8**, that is, the routine of FIG. **9** is performed again. Moreover, in step S**48** of FIG. **9**, if $|Xd1-Xsn| \leq L$ is established (the affirmation determination in S**48**), the ejection starting position adjustment amount $\Delta X=Xd1-Xsn$ is set in step S**49**. In this case, the paper end detection flag is renewed to F**1**=0 (S**55**).

Furthermore, even when the feeding error is generated in the first page, since the paper end detection flag is in the state of F1=1, the routine of FIG. **9** is performed in the re-feeding course of the first page after the feeding error is released. Moreover, in step S**48** of FIG. **9**, if |Xd**1**−Xsn|≤L is established (the affirmation determination in S**48**), the ejection starting position adjustment amount ΔX=Xd**1**−Xsn is set in step S**49**. In this case, the paper end detection flag is renewed to F**1**=0 (S**55**). For example, when the feeding error is continued, in the re-feeding course when the feeding error is released, the routine of FIG. **9** is performed, and the routine is repeatedly performed in every feeding course until the ejection starting position adjustment amount ΔX (=Xd**1**−Xsn) is set.

Furthermore, when the paper set position in the additional cassette **19** deviates in the width direction, |Xd**1**−Xsn|≤L is not established, and the ejection starting position adjustment amount ΔX (=L or −L) is set, the routine of FIG. **9** is performed in every feeding course, and the routine is performed in every feeding course until the deviation of the paper set position is solved. Moreover, when the paper set position in the additional cassette **19** is correctly fixed, in the next additional cassette paper feeding process routine, the ejection starting position adjustment amount ΔX (=Xd**1**−Xsn) is set (S**49**).

In this manner, after the ejection starting position adjustment amount ΔX (=Xd**1**−Xsn) after the power source is turned off, the ejection starting position adjustment amount ΔX is adopted until the power source is turned off.

Furthermore, when the additional feeding device **18** is mounted after the power source is turned on, after the mounting of the feeding device **18** is detected by the additional detection sensor **67**, when the paper feeding from the additional cassette **19** is firstly selected, the additional cassette paper feeding process routine shown in FIGS. **8** and **9** is performed. For this reason, even when the additional feeding device **18** is mounted after the power source is turned on, the ejection starting position adjustment amount ΔX is set, whereby the printing is performed in a suitable printing range in the width direction of the paper.

As mentioned above, in the present embodiment, the effects described below can be obtained.

(1) After the power source is turned on, the paper width detector **52** detects the first side end position Xd**1** of the paper P fed from the feeding device **18** in the feeding course before the printing start. Moreover, the calculation portion **88** calculates the deviation amount ΔX between the first side end position Xd**1** detected by the paper width detector **52** and the design (theoretical) side end position Xsn. The main control portion **81** (the adjustment unit) adjusts the limit position of the printing range in the width direction, in which the printing of the recording head **22** is permitted, by the use of the deviation amount ΔX (the adjustment amount). Thus, it is possible to suppress the deviation of the printing range to the paper P in the width direction due to the mounting deviation of the detachable feeding device **18**.

(2) The paper width detector **52** detects the first side end position of the paper P that is fed from the feeding device **18** in the first page of the initial printing (the printing operation), after the feeding device **18** is mounted after the power source is turned on. Thus, during printing by the feeding from the detachable feeding device **18**, it is possible to suppress the deviation of the printing range in the width direction from the first page of the initial printing.

(3) Both side end positions of the paper P in the width direction are detected by the paper width detector **52** provided in the carriage **13**. The deviation amount ΔX is calculated by the use of at least the first side end position Xd**1** of both side end positions detected at this time. Moreover, by the main control portion **81**, the ejection starting position (the recording starting position) of the recording head **22** is adjusted which is moved together with the carriage **13** to perform the printing, by the use of the deviation amount ΔX. Thus, in the serial type printer **11**, the ejection starting position of the recording head **22** is adjusted, whereby it is possible to suppress the deviation of the printing range in the width direction of the paper P.

(4) When the feeding error of the paper P is detected before the adjustment by the main control portion **81**, the first side end position Xd**1** is detected in the next feeding course from the feeding device **18** after the feeding error is relived to acquire the deviation amount ΔX, and the main control portion **81** adjusts the limit position of the printing range by the use of the acquired deviation amount ΔX. Thus, even when the feeding error is generated, one of the first side end position Xd**1**, the deviation amount ΔX, and the limit position of the recording range can be acquired, and, as a result, the ejection starting position (the limit position of the printing range) cannot be adjusted, in the next feeding course from the feeding device **18** after the feeding error is released, the adjustment amount of the ejection starting position is adjusted again. Thus, even when the feeding error is unexpectedly generated in the feeding when performing the adjustment process, it is possible to suppress the deviation of the recording range of the paper P in the width direction in the next printing.

(5) When it is determined that the deviation amount |ΔX| exceeds the limit value L (the limiting value) by the third determination portion **91**, the main control portion **81** sets the limit value L as the ejection starting position adjustment amount ΔX, and sets the ejection starting position Xst by the use of the ejection starting position adjustment amount ΔX (=L or −L). For example, even when an excessive deviation amount ΔX is calculated due to the fact that the paper P set position in the feeding device **18** deviates in the width direction, since the ejection starting position adjustment amount ΔX is limited to the limit value L, the position can be adjusted to a suitable ejection starting position. Thus, it is possible to avoid the deviation of the printing range to the paper P in the width direction due to the fact that the excessive ejection starting position adjustment amount ΔX is set according to the deviation of the paper P set positions in the additional cassette **19**, then, the excessive ejection starting position adjustment amount ΔX is consecutively used, and is adjusted to the unsuitable ejection starting position Xst.

(6) After the ejection starting position adjustment amount ΔX is set by the main control portion **81**, until the power source is turned off, the ejection starting position Xst (the limit position of the recording range) based on the ejection starting position adjustment amount ΔX is adopted, whereby the printing (the ink droplet ejection) is performed by the recording head **22**. Thus, at every printing fed from the additional feeding device **18**, there is no need to perform the process that includes the detection of the first side end position Xd**1**, the calculation of the ejection starting position adjustment amount ΔX, and the adjustment of the ejection starting position Xst (the limit position of the recording range). As a consequence, for example, it is possible to improve the throughput of the printing at the time of the feeding from the additional feeding device **18**.

(7) When the additional feeding device **18** is a center feeding type, the first side end position is changed depending on the paper sizes, but even if the paper sizes are different, it is possible to adjust the ejection starting position Xst (the limit

position of the printing range) by the use of the same ejection starting adjustment amount ΔX. Thus, in any paper size, it is possible to suppress the deviation of the printing range to the paper P in the width direction due to the recording head **22**.

(8) when the deviation amount |ΔX| exceeds the limit value L, since the ejection starting position adjustment amount ΔX=L or ΔX=−L is adopted, the suitable ejection starting position Xst can be adopted. If the paper P set position in the additional cassette **19** deviates in the width direction, it is possible to adopt the more suitable ejection starting position Xst to perform the suitable printing, and meanwhile, even if the paper P set position in the additional cassette **19** is correct and the mounting deviation of the feeding device **18** is a cause, it is possible to adopt the more suitable ejection starting position Xst to perform the suitable printing.

(9) when the deviation amount |ΔX| exceeds the limit value L, since the paper end detection flag F**1** is not set to "0", until the deviation amount |ΔX| is equal to or less than the limit value L, the paper end detection processes (S**24** to S**28**) are repeatedly performed. For this reason, if the paper P set position in the additional cassette **19** deviates in the width direction, until the set position is corrected, the paper end detection is performed every time, and the ejection starting position Xst is obtained by the use of the ejection starting position adjustment amount ΔX depending on the first side end position Xd**1** of the paper P of that time. For this reason, it is possible to perform the printing from the more suitable ejection starting position Xst. Moreover, after the paper P set position in the additional cassette **19** is corrected, in the paper end detection of the first page of the printing by the paper feeding from the additional cassette **19**, since the deviation amount |ΔX| is equal to or less than the limit value L, after that, the ejection starting position adjustment amount ΔX set at this time is adopted, whereby the printing can be performed from the suitable ejection starting position Xst.

In addition, the embodiment mentioned above can be changed in the form as below.

- A configuration may be adopted which obtains the ejection starting position adjustment amount ΔX by adopting the second side end position Xd**2**. Furthermore, the standard position may be the design side end position of the counter-home position side, without being limited to the design side end position of the home position side. In addition, it may be possible to adopt the design side end positions of both of the home position side and the counter-home position side, that is, the first design side end position and the second design side end position. In this case, it is also possible to adopt a configuration in which each deviation amount acquired by the use of the respective design side end positions and the actually detected first side end position Xd**1** and second side end position Xd**2** are set to the adjustment amounts, respectively, and the recording starting position of the forward movement course and the recording starting position of the backward movement course are obtained by the use of the respective adjustment amounts.
- Instead of the ejection starting position adjustment amount ΔX, a configuration may be adopted in which the ejection starting position Xst is obtained by the use of the first side end position Xsn after the correction, by setting the first side end position Xsn (=Xsn+ΔX) after the correction in which the first design side end position Xsn is added with the correction for each paper size.
- When the deviation amount |ΔX| exceeds the limit value L, the ejection starting position adjustment amount ΔX is not set to the limit value L, but the ejection starting position adjustment amount ΔX may be set to ΔX=0.
- By eliminating the determination whether or not the deviation amount |ΔX| is equal to or less than the limit value L, the limitation may be released by which the limit value L is set to the upper limit or the lower limit of the ejection starting position adjustment amount ΔX.
- The paper width PW used in the process (S**41**) of calculating the first design side end position Xsn is obtained from the paper size, but the first design side end position Xsn may be calculated by the use of the paper width PW (=Xd**2**−Xd**1**) measured from the both side end positions detected by the paper width detector **52**.
- The additional feeding device **18** (that is, the additional cassette **19**) is not limited to the center feeding type (a centering paper feeding type). For example, it may be possible to adopt a unilateral approach type in which a paper guide includes a fixing guide and an available guide, and the paper feeding is performed while guiding the paper in a position brought near to one side by brining one side end of the paper into contact with the fixing guide. In this manner, even in the case of the bilateral approach paper feeding type, it is possible to perform the more suitable printing from the ejection starting position (the recording starting position) where the mounting deviation of the case of mounting the additional feeding device **18** is adjusted.
- The ejection starting position adjustment amount ΔX may be obtained whenever the printing is performed in which the paper is fed from the additional cassette **19**, by abolishing the paper end detection flag F**1**. In this case, a configuration may be adopted which sets the ejection starting position adjustment amount ΔX in the initial first page for each printing operation, and a configuration may be adopted in which the ejection starting position adjustment amount ΔX is set for each page.
- Instead of the paper end detection that detects the first side end and the second side end of the paper, a configuration may be adopted in which only one side end position required for the correction of the ejection starting position is detected.
- The feeding error is not limited to the embodiment mentioned above. For example, the paper size (the recording medium size) may be detected based on the both side end positions detected by the paper width detector **52** (a medium width detection unit), and the detected paper size may be a feeding error different from the paper size of the printing set information. Moreover, in the case of the feeding error, a configuration may be adopted which resets the ejection starting position adjustment amount ΔX. According to the configuration, the paper size is detected based on the both side end positions detected by the paper width detector **52**, in a case where the detected paper size is different from the set paper size, when the next paper is fed from the additional feeding device **18**, the detection of the side end position, the calculation of the deviation amount |ΔX| (that is, the ejection starting position adjustment amount ΔX), and the adjustment of the ejection starting position Xst are performed again. Thus, even when the paper size of the printing setting does not coincide with the actual paper size and this kind of feeding error is generated, since the ejection starting position Xst (the limit position of the recording range) is adjusted again, it is possible to perform the printing on the paper in the suitable printing range in the width direction.

The respective functional portions of the control portion **71** in the computer **70** in FIG. **5** were realized mainly by software by the CPU executing the program. However, the respective

functional portions may be realized by hardware by an integrated circuit such as ASIC or may be realized by the cooperation between the software and the hardware.

The recording apparatus may be a lateral type printer, a line printer, and a page printer, without being limited to the serial printer. Furthermore, the recording apparatus can also be applied to a dot impact type recording apparatus without being limited to the ink jet type. In summary, the invention can widely be applied to a recording apparatus which can detachably mount the feeding device on the recording apparatus main body and has a configuration in which the limit position of the recording range in the recording medium in the width direction deviates due to the mounting deviation when mounting the feeding device on the main body, despite the fact that the paper is set in the feeding cassette in the correct position in the width direction. For example, in the case of the line printer, a line sensor extended in the width direction is provided as the detection unit, and the side end position of the paper is detected by the line sensor. Moreover, when implementing the additional feeding device, the deviation amount between the design side end position and the detected side end position due to the mounting deviation of the feeding device to the printer main body are set as the adjustment amount. In addition, a configuration is adopted which adjusts the limit position of the recording range (the ink ejection range) in which the recording by the line type recording head is permitted by the use of the adjustment amount.

In the embodiment mentioned above, the ink jet type printer **11** is adopted as the recording apparatus, but a fluid ejecting device may be adopted which ejects or discharges another fluid other than ink. Furthermore, the invention can be used in various liquid ejecting devices that include a liquid ejection head or the like which discharges a minute amount of liquid droplet. In this case, the liquid droplet refers to a liquid state discharged from the liquid ejecting device, and also includes matter leaving traces in a gradual shape, a tear shape and a filiform. Furthermore, liquid mentioned herein may be a material that can be ejected by the liquid ejecting device. For example, the matter of a condition when the substance is a liquid phase may be used, and liquid having high or low viscosity, sol, gel water, other inorganic solvent, organic solvent, solution, liquid resin, a flow-like body such as a liquid metal (metallic melt), liquid as one state of a substance, as well as matter in which particles of the functional material formed of solid matter such as pigment or metallic particle are solved, dispersed, or mixed in the solvent or the like are included. Furthermore, as a typical example of the liquid, ink, liquid crystal or the like as described in the embodiment mentioned above are included. Herein, ink includes various liquid compositions such as general water-based ink, oil-based ink, gel ink, and hot-melt ink. As a specific example of the liquid ejecting device, for example, it is possible to adopt a liquid crystal display, an EL (electroluminescence) display, a plane emission display, a liquid ejecting device which ejects liquid containing the material such as an electrode material or a color material used in the manufacturing of the color filter or the like in the form of the dispersion or the dissolution. In addition, the liquid ejecting device may be a liquid ejecting device that ejects living body organic matter used in manufacturing a bio chip, a liquid ejecting device that is used as a precision pipette and ejects liquid becoming a sample, a printing device, a micro dispenser or the like. In addition, it may be possible to adopt a liquid ejecting device that ejects lubricant oil to precision machine such as a watch or a camera by a pinpoint, a liquid ejecting device that ejects transparent resin liquid such as ultraviolet curing resin for forming a micro hemispherical lens (an optical lens) used in an optical communication element or the like onto a substrate, and a liquid ejecting device that ejects etching liquid such as acid or alkali for etching the substrate or the like. Moreover, the invention can be applied to any one kind of liquid ejecting device among them. Furthermore, the fluid may be particulate matter such as a toner. In addition, the fluid described in the specification does not include matter formed only of gas.

What is claimed is:

1. A recording apparatus on which a feeding device is detachably mounted for feeding a recording medium, the apparatus comprising:

a transport unit that transports the recording medium;

a recording unit that records the recording medium;

an acquisition unit that acquires a theoretical side end position in a width direction intersecting with a transport direction of the recording medium;

a detection unit that detects a side end position of the recording medium which is fed from the feeding device;

a calculation unit that calculates a deviation amount between the side end position detected by the detection unit and the theoretical side end position as an adjustment amount; and

an adjustment unit that adjusts a recording range of the recording unit by the use of the adjustment amount,

wherein the adjustment unit adjusts the recording range in a first page of an initial recording after at least the feeding device is mounted.

2. The recording apparatus according to claim **1**,

wherein the recording unit is a carriage which has a recording head and is able to be moved in the width direction,

the detection unit includes a medium width detection unit which is provided in the carriage and is able to detect both side end positions of the recording medium in the width direction by the movement of the carriage,

the detection unit moves the carriage before the recording starting in the feeding course from the feeding device to detect both side end positions by the medium width detection unit, and

the adjustment unit adjusts the recording starting position of the recording head which is moved together with the carriage by the use of the adjustment amount to perform the recording.

3. The recording apparatus according to claim **1**, further comprising:

an error detection unit which detects a feeding error of the recording medium,

wherein, when the feeding error of the recording medium is detected before the adjustment by the adjustment unit, the side end position is detected in the next feeding course from the feeding device after the feeding error is released, and the adjustment unit adjusts the recording range by the use of the acquired adjustment amount.

4. The recording apparatus according to claim **1**, further comprising:

a determination unit that determines whether or not a deviation amount exceeds the limit value,

wherein the adjustment unit limits the adjustment amount to the limit value when it is determined that the deviation amount exceeds the limit value.

5. The recording apparatus according to claim 1,
wherein, after the recording range is adjusted by the adjustment unit, until a power source is cut off, the recording by the recording unit is performed based on the adjusted recording range.

6. The recording apparatus according to claim 1,
wherein the feeding device is a center feeding type that guides the recording medium near the center.

7. A recording method in a recording apparatus on which a feeding device is detachably mounted for feeding a recording medium, the method comprising:
detecting a side end position in a width direction intersecting with a transport direction of the recording medium which is fed from the feeding device;
calculating a deviation amount between the side end position detected during the detecting of the side end position and a theoretical side end position as an adjustment amount; and
adjusting a recording range of the recording unit by the use of the adjustment amount,
wherein, in the adjusting of the recording range, the recording range is adjusted in a first page of an initial recording after at least the feeding device is mounted.

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